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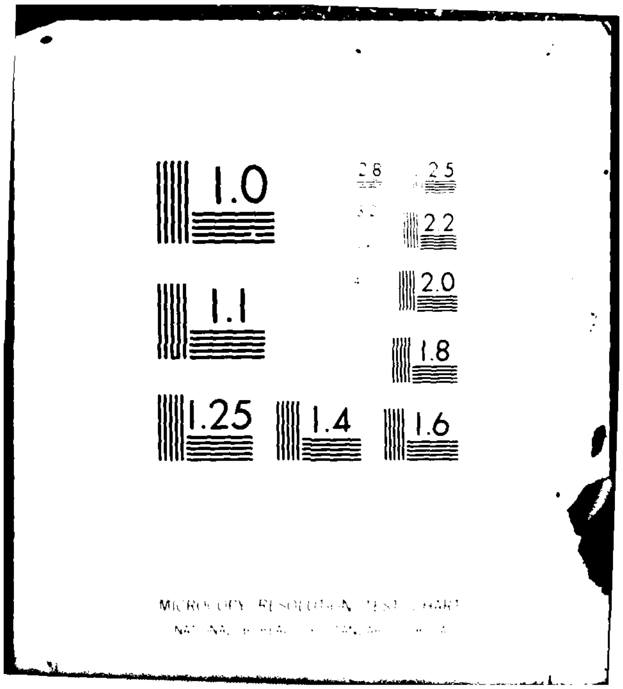
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MAY 1982

FINAL

ENVIRONMENTAL STATEMENT/ENVIRONMENTAL IMPACT REPORT

NORTH BAY AQUEDUCT

(Phase II Facilities)

SOLANO COUNTY, CALIFORNIA

Regulatory Permit Application
made by the
California Department of Water Resources
to the U. S. Army Corps of Engineers
Public Notice 12950-58

U. S. ARMY ENGINEER DISTRICT
San Francisco, California

DEPARTMENT OF WATER RESOURCES
CENTRAL DISTRICT
Sacramento, California

DEPARTMENT OF THE ARMY
SAN FRANCISCO DISTRICT, CORPS OF ENGINEERS
211 MAIN STREET
SAN FRANCISCO, CALIFORNIA 94105

SPNMD-CE/SPNCO-R

25 June 1982

RESPONSE REQUIRED BY: 26 July 1982

SUBJECT: COMMENT PERIOD FOR NORTH BAY AQUEDUCT, PHASE II FACILITIES FINAL ENVIRONMENTAL STATEMENT (PUBLIC NOTICE NO. 12950-58)

TO WHOM IT MAY CONCERN:

1. As announced in Public Notice No. 12950-58 (29 November 1979), the California Department of Water Resources, Central District, P. O. Box 160088, Sacramento, California, has applied for a Department of the Army permit under Section 10 of the River and Harbor Act of 1899 and under Section 404 of the Clean Water Act to construct various facilities for the purpose of conveying Sacramento - San Joaquin Delta water overland to supply water users in Solano and Napa Counties.

2. In response to the National Environmental Policy Act of 1969, Public Law 91-190, the San Francisco District, U. S. Army Corps of Engineers, has prepared a Final Environmental Statement (FES) for the subject permit application. In accordance with the Regulations For Implementing the Procedural Provisions of The National Environmental Policy Act (40 CFR 1506.2), a joint Federal/State Report has been prepared to minimize duplication of effort.

3. This office is now soliciting comments and views of appropriate government agencies, and interested groups and individuals concerning the FES. Please submit your comments to the District Engineer, San Francisco District, by the date indicated above so that they can be considered along with other relevant information in the permit review process

4. Copies of the FES are available for review by contacting the San Francisco District (415-974-0445).

Sincerely,

THOMAS J. EDGERTON
Major, CE
District Engineer

FINAL
ENVIRONMENTAL STATEMENT/
ENVIRONMENTAL IMPACT REPORT

NORTH BAY AQUEDUCT
PHASE II FACILITIES
Solano County, California

Regulatory Permit Application
made by the
California Department of Water Resources
to the
U. S. Army Corps of Engineers

U. S. Army Corps of Engineers Public Notice 12950-58

U. S. Army Engineer District
San Francisco, California

Department of Water Resources
Central District
Sacramento, California

May 1982

Cover Sheet

NORTH BAY AQUEDUCT PHASE II FACILITIES
Solano County, California

REGULATORY PERMIT APPLICATION
MADE BY THE
CALIFORNIA DEPARTMENT OF WATER RESOURCES
TO THE
U. S. ARMY CORPS OF ENGINEERS

U. S. ARMY CORPS OF ENGINEERS PUBLIC NOTICE 12950-58

( ) DRAFT ENVIRONMENTAL STATEMENT (X) FINAL ENVIRONMENTAL STATEMENT

Responsible Agencies: U. S. Army Engineer District, San Francisco
211 Main Street
San Francisco, California 94105

California Department of Water Resources
Central District
3251 S Street
Sacramento, California 95816

Contact Person: Barney Opton
Environmental Resources Planner
Environmental Branch
Corps of Engineers, San Francisco District
(415) 974-0445

1. Name of Action: (X) ADMINISTRATIVE ( ) LEGISLATIVE

2. Authority: Section 10 of the River and Harbor Act of 1899 and Section 404 of the Clean Water Act.

3. Description of Action: The project would divert Sacramento-San Joaquin River Delta water from one of three locations in eastern Solano County overland by pipeline and aqueduct to tie into Phase I aqueduct facilities near Cordelia, California.

4. Environmental Impacts: Possible disruption of biological habitats in the Jepson Prairie and Suisun Marsh that support threatened and endangered plant and animal species; disruption and/or encroachment on prime farmland; temporary disruption of the Fairfield linear park system; possible growth-inducing impacts; consumption of large amounts of energy for construction and during operation and maintenance of the aqueduct; increased noise and dust levels due to construction; generation of large amounts of dredged material from maintenance dredging of intake channels; provision of supplemental water supplies to Solano and Napa counties; and possible cumulative impact to Bay-Delta fish and wildlife, Delta water supply, and Delta water quality.

5. Alternatives Considered: Alternative sources of water including conservation, alternative alignments, no project.

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CONTENTS (Continued)

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TABLES (Continued)

INTRODUCTION

The Department of Water Resources' preferred alternative includes the Route 1 alignment of the North Bay Aqueduct plus urban water conservation programs that will be implemented through enforceable institutional means. The preferred alternative for the Final Environmental Statement/Environmental Impact Report (ES/EIR) is based on a review of all public comments received on the Draft ES/EIR, discussions with representatives of local water contracting agencies, and an extensive review of the alternative water supply and of municipal and industrial (M&I) demands presented in Chapter 3.0 of the Draft ES/EIR. Inclusion of urban water conservation in the preferred alternative assures implementation of urban water conservation measures along with construction of the North Bay Aqueduct and provides important mitigation for fishery impacts by delaying full entitlement diversions.

The Route 1 alignment is described in the Draft ES/EIR (pages 47-48). This alignment diverts Sacramento-San Joaquin Delta water for M&I use in Solano and Napa counties from Cache Slough in eastern Solano County by underground pipeline to tie into existing Phase I aqueduct facilities near Cordelia, California.

Possible water conservation measures for all North Bay Aqueduct contracting agencies have been added to the Final ES/EIR. A general description of these measures is presented in Appendix I. These measures are used in draft urban water conservation plans for Solano and Napa counties, which are included as Appendices II and III of this final report. The measures presented in these draft plans include measures currently implemented in the service areas and new measures suited to the character and needs of the service area. Negotiations in progress between the Department of Water Resources and North Bay Aqueduct contracting agencies are designed to establish conservation programs that will be implemented through enforceable institutional means including goals or specific conservation measures. Such programs will be reasonable, practical, and economically achievable. The draft urban water conservation plans are being reviewed in current negotiations. The Final ES/EIR also presents potential water savings that correspond to specific conservation measures and these savings could be the framework for the goals of a water conservation program.

Under the preferred alternative, conservation programs will be designed to extend contract entitlement further into the future and there will be no reduction in maximum annual entitlements. The Department has set a first priority for the use of available nonproject funds to offset a portion of the costs associated with implementing conservation measures and will also use project funds to finance parts of the measures. In addition, the Department will negotiate rescheduling of contracted annual entitlement deliveries to compensate for water conservation savings and new demand predictions. This rescheduling will spread the existing delivery schedule volumes over a longer period of time, thereby reducing annual deliveries and payments.

The Final ES/EIR is divided into three sections. Section 1 is a general response to major comments on the Draft ES/EIR and a detailed explanation of all changes made to Chapter 3.0 of the Draft ES/EIR, which describes water needs and alternatives. Section 2 contains copies of the written comments received and specific responses to them. Section 3 consists of corrections and additions to the Draft ES/EIR, presented in order of their appearance in the draft report. The Draft ES/EIR is included as Appendix V to the Final ES/EIR.

The information contained in this document, combined with the Draft ES/EIR, fulfills both the Federal and State environmental guidelines for the content of a Final ES/EIR.

Public Involvement

Guidelines of the National Environmental Policy Act of 1969 (NEPA) and the California Environmental Quality Act of 1970 (CEQA) require that the sponsoring or lead agency respond in writing to all comments received during the public review of the Draft Environmental Statement/Environmental Impact Report (ES/EIR). The response to these comments, the Draft ES/EIR, and revisions to the Draft ES/EIR constitute the Final ES/EIR.

Public participation has been an important component in developing the North Bay Aqueduct ES/EIR. Early and regular consultation with responsible agencies and the public was instrumental in preparing the Draft ES/EIR (see Section 10.0 of the Draft ES/EIR).

A Draft ES/EIR on the North Bay Aqueduct Phase II facilities was distributed for review in June 1981. A public hearing to receive questions or comments on the Draft ES/EIR was held on July 29, 1981, in Fairfield. In addition, written comments were received during the review period. Important comments included concern for disruption of agricultural operations, protection of Jepson Prairie flora, cost of the alternative alignments, cumulative impacts, and the information presented in the draft on water demands and water supply alternatives.

The public review period for the Draft ES/EIR ended August 17, 1981; the federal review period ended August 31. Agencies, organizations, and individuals who responded to the Draft ES/EIR were:

U. S. Environmental Protection Agency
National Marine Fisheries Service
U. S. Department of the Interior
U. S. Department of Transportation
Federal Energy Regulatory Commission (San Francisco)
Federal Energy Regulatory Commission (Washington)
U. S. Coast Guard
U. S. Department of Agriculture, Forest Service
Advisory Council on Historic Preservation
The Resources Agency of California
California Department of Transportation
California Regional Water Quality Control Board
University of California Natural Land and Water Reserves System

University of California Natural Land and Water Reserves System
California Department of Parks and Recreation
Office of Historic Preservation
Yolo-Solano Air Pollution Control District
Napa County Flood Control and Water Conservation District
American Canyon Water District
City of Napa
City of Vallejo
San Joaquin County Council of Governments
City of Vacaville
Fairfield Suisun Sewer District
Solano County Board of Supervisors
City of Fairfield
Environmental Defense Fund
Friends of the River
Pacific Gas and Electric Company
The Nature Conservancy
California Native Plant Society
State Senator Jim Nielson
Downey, Brand, Seymour, and Rohwer
James Grossi, Jr., Inc.
Ben Allustiarte
Richard Emigh
Roger Souza

Copies of the Final ES/EIR will be furnished to all those who received the Draft report, plus others not on this list who have requested a copy of the Final report.

SECTION 1. GENERAL RESPONSE TO PUBLIC REVIEW COMMENTS ON THE WATER NEEDS AND ALTERNATIVES PRESENTED IN THE DRAFT ENVIRONMENTAL STATEMENT/ENVIRONMENTAL IMPACT REPORT

Major comments received on the Draft North Bay Aqueduct Environmental Statement/Environmental Impact Report (Draft ES/EIR) required further investigation of "Water Needs and Alternatives" (Chapter 3.0 of the Draft ES/EIR). The findings of this investigation as presented in this section supersede or add to the information presented in the Draft ES/EIR. This section represents the changes and explanation of changes for Chapter 3.0 of the Final ES/EIR as well as a general response to major comments on the Draft ES/EIR.

This investigation was needed to reexamine the potential of water supply alternatives and to determine the preferred alternative's consistency with the State's water resources management policy, exemplified by the general policy statement, "Water resources already developed shall be used to the maximum extent before new sources are developed."

This investigation was done with special attention given to specific State water management policies that focus on conjunctive use of surface and ground water supplies, water conservation, reclamation and reuse of water, and energy considerations in the planning process. These policies are presented in a joint draft bulletin issued in June 1981 by the Department of Water Resources and the State Water Resources Control Board. This draft bulletin introduces the State's Water Resources Management Policies by stating: "In certain instances, managers, administrators, and members of boards or commissions will find it necessary to use their discretion in applying these policies within the interpretations presented."

Changes made to Chapter 3.0 of the Draft ES/EIR as a result of this investigation include:

- Updating, correcting, and expanding information on all water supply alternatives, population projections, municipal and industrial (M&I) water demands, and anticipated M&I supplemental water requirements.

- Categorizing all supplies according to their potential to provide a firm M&I supply for Solano and Napa counties.

- Developing comprehensive urban water conservation plans for Solano and Napa counties that specify possible conservation measures for all North Bay Aqueduct contracting agencies and provide important mitigation for fishery impacts by extending contracted entitlement buildup schedules and correspondingly delaying North Bay Aqueduct annual diversion increases.

- Increasing the values for the projected reuse of agricultural drainage water to offset projected agricultural demands.

- Using information from the U. S. Bureau of Reclamation operation study of Lake Berryessa to revise the estimate of potential additional supplies for

Solano County from conjunctive use of surface water and ground water supplies.

- Revising the preferred water supply alternative to include implementation of reasonable and enforceable water conservation programs.

- Addition of an environmental impact review of various alternative water supplies that could potentially supplement the North Bay Aqueduct.

These changes and others made to the Draft ES/EIR are indicated in this section and in Section 3, Corrections and Additions to the Draft ES/EIR. Preliminary urban water conservation plans developed by the Department of Water Resources for Solano and Napa counties are presented in Appendices II and III of the Final ES/EIR.

The results of the investigation confirm several conclusions of the Draft ES/EIR:

- The North Bay Aqueduct is needed before 1990 as a firm supply to meet the supplemental M&I water requirements for Solano and Napa counties.

- The combined total potential supply from all alternative sources will not guarantee a firm M&I supply sufficient to meet the supplemental water demands for Solano and Napa counties without the North Bay Aqueduct, and therefore the combined alternative supplies cannot independently constitute an alternative to the North Bay Aqueduct.

- Alternative supplies to the North Bay Aqueduct can provide an additional source of M&I water and water conservation measures can delay the future M&I demands in Solano and Napa counties, which will significantly complement the North Bay Aqueduct deliveries and extend the adequacy of this facility to meet demands beyond the time that is projected by contract entitlement buildup schedules.

- Use of existing supplies have been maximized in accordance with State Water Resources Management Policy.

The investigation consisted of:

- Researching information that has become available since publication of the draft.

- Reviewing references from which information was obtained for the draft report to check accuracy and compatibility with other information used for the draft.

The investigation was based on the following information. Memorandum reports are on file with the Department of Water Resources.

1. Memorandum Report. "Water Action Plan for the Southwest Sacramento Valley Service Area", Department of Water Resources, October 6, 1980. (This report was in progress when the Draft ES/EIR was published.)

2. "Solano County Water Project California, Concluding Report on the Feasibility Investigation of Agricultural, Municipal, and Industrial Water Requirements of Solano County", U. S. Department of the Interior, Water and Power Resources Service (now U. S. Bureau of Reclamation), October 1980.

3. Memorandum Report. "State Water Project Future Supply -- Alameda, Napa, Santa Clara, and Solano County", Department of Water Resources, December 1981.

4. 1980 Department of Finance Populations for Solano and Napa Counties.

5. "Draft Solano County Flood Control and Water Conservation District Urban Water Conservation Plan", Department of Water Resources, November 1981 (Appendix II of the Final ES/EIR).

6. "Draft Napa County Flood Control and Water Conservation District Urban Water Conservation Plan", Department of Water Resources, November 1981 (Appendix III of the Final ES/EIR).

7. "Policies and Goals for California Water Management; The Next 20 Years". Public Review Draft. State Water Resources Control Board and Department of Water Resources, June 1981.

8. Memorandum Report. "An Operation Study of Lake Berryessa by USBR Used by the Department of Water Resources to Estimate the Potential for Conjunctive Use of Surface and Ground Water", Department of Water Resources, January 1982.

9. "Geology, Water Resources, and Usable Ground-Water Storage Capacity of Part of Solano County, California", USGS Water-Supply Paper 1464, 1960.

10. "Sacramento Valley", Department of Water Resources Bulletin 118-6, 1978.

Water supply alternatives were classified and rated to clarify their potential for providing firm supplies for M&I supplemental water needs projected to occur prior to 1990 in Solano and Napa counties (see Table 3-1(F)). Urban water conservation measures included conservation for industry and were considered separate from water supply alternatives. Classifications were: no potential, limited potential, and high potential.

The "no potential" classification was used to identify alternatives that could not be used to supplement or replace North Bay Aqueduct M&I supplies because of institutional, environmental, economic, social, or technical constraints.

The "limited potential" classification was used to identify alternatives that present information shows cannot be used as a substitute supply because of the constraints previously mentioned. However, these alternatives are being investigated in ongoing Department studies and future advances in technology or future study findings could make these alternative supplies available. The application of these "limited potential" alternatives cannot be relied upon to improve within the next three to eight years. During this period, shortages in M&I supplies are expected for Solano and Napa counties and action must be taken now to allow for construction time of a facility with a firm supply.

An evaluation included in this section considered the "limited potential" alternatives as substitute North Bay Aqueduct supplies even though there were uncertainties associated with these alternatives. This evaluation showed that even with application of the maximum potential water supplies of these alternatives, to meet the M&I needs of Solano and Napa counties, the North Bay Aqueduct is still needed to meet supplemental M&I water requirements (see Tables 3-2(F) and 3-4(F)).

The "high potential" classification identified supplies and measures that can provide a firm supply before 1990.

Water supply alternatives classified as "no potential" were: (1) desalination of water from Suisun Slough in southern Solano County; (2) Solano Project reanalysis; (3) West Sacramento Valley Canal development; and (4) ground water supply development. The ground water supply development alternative did not include the variations of conjunctive use of surface and ground water supplies.

Desalination of Suisun Slough

The Draft ES/EIR indicates (page 35, paragraph 3.2.4.8) that: "Desalination of Suisun Slough water would be expensive and energy-intensive, and the technology must be considered somewhat uncertain." The Draft ES/EIR points out that the Department of Water Resources is actively working with desalination as a method to develop water supplies in California. However, the unsuitability of the diversion location at Suisun Slough makes desalination of Suisun Slough for an alternative North Bay Aqueduct supply infeasible. Five *additional factors* have been identified that combine to add to the cost and reduce the feasibility and desirability of this alternative because of the unsuitability of the diversion location at Suisun Slough. The factors listed below will add to the estimated costs of $300 per acre-foot listed in the Draft ES/EIR for this alternative.

- Disruption of the planned Suisun Marsh Overall Protection Facilities. These facilities have been designed to change the marsh's hydraulic characteristics to protect water quality in marsh channels. The current design of the facilities maximizes flow capacity of major existing marsh channels and proposed facilities. Because these flow rates are just sufficient to meet the water quality and quantity needs of the marsh, a diversion from Suisun Slough would disrupt the effectiveness of the planned facilities. Modification of the proposed facilities to compensate for the Suisun Slough diversion would require enlargement of the control facilities, main existing marsh channels, and new artificial channels designed to deliver water from Collinsville to the northern marsh area. These facilities and channels are: (1) Montezuma Slough Control Structure, (2) Montezuma Slough between Collinsville and Nurse Slough, (3) Potrero Ditch, (4) Luco Slough, and (5) Hill Slough. The cost of modifying these facilities and channels would be expensive and would make diversions at Suisun Slough economically infeasible. In addition, dredging these channel enlargements would create substantial disruptive environmental impacts beyond those involved in the presently planned overall marsh facilities.

- Increased Delta outflow requirements needed to compensate for a diversion at Suisun Slough when the water projects are under controlled flow conditions. Controlled flow conditions exist when the Delta outflow requirements are being met from project storage releases. The diversion would cause an increase in salinity in the Sacramento River at Collinsville if fresh water were not released from upstream reservoirs. Collinsville is a water quality control station specified in Water Rights Decision 1485. The necessary replacement supply would not equal 100 percent of the diversion; however, it would constitute a significant portion of the diverted supply. The compensating release of fresh water would represent a reduction of firm State Water Project (SWP) yield and therefore would offset the effectiveness of the desalination plan in Suisun Marsh. Without a replacement supply, the resulting altered salinity gradient would cause general salinity increases in the Delta estuary system. North Bay Aqueduct diversions under controlled flow conditions also need a replacement supply. Department planning to the year 2000 includes 100 percent of this replacement from project storage and cost figures in the Final ES/EIR include the cost of this project water.

- Problems associated with disposal of waste brine generated by a desalting plant. The Draft ES/EIR suggested (page 19, paragraph 3.2.2.4.3) that the waste brine discharged from a Suisun Slough desalination plant might be transported by pipeline to Carquinez Strait. This waste disposal would impact not only the immediate area of discharge but also a wider area due to tidal activity.

- Problems associated with high concentrations of total dissolved solids. The Draft ES/EIR compared the quality of Suisun Slough to the quality of agricultural drainage water in the San Joaquin Valley (5,000-10,000 ppm TDS). This is true only during the months in which the Suisun Marsh facilities will be operating to meet water right standards for the Marsh -- October through May. In other months, the quality could reach 20,000 ppm TDS. This higher salinity at the Suisun Slough diversion location would require a technologically more complicated desalination system.

- Environmental conditions at the proposed intake, requiring protection measures. Suisun Slough is a main waterway within the Suisun Marsh, which provides nursery areas and habitats for striped bass and other fish. Consequently, screening at this diversion location would be required. In addition, the brackish water conditions at Suisun Slough would create serious screen-cleaning problems.

Based on all available information, desalination of Suisun Slough water is not considered a viable source of M&I water for Solano and Napa counties.

Solano Project Reanalysis

New information on the Solano Project reanalysis was obtained by conversation with representatives of the Solano County Flood Control and Water Conservation District and by comments received on the Draft ES/EIR. The water supply evaluation summary, Table 3-1 in Chapter 3.0 of the Draft ES/EIR, indicated that 20,000 acre-feet of additional water supply would potentially be available in the year 2000 from this reanalysis. The correct value for this potential supply, as determined by the U. S. Bureau of Reclamation (USBR), is

13,000 acre-feet (Four-Counties Study, Water Management Opportunities for Lake, Napa, Solano, and Yolo Counties, Status Report, Water and Power Resources Service, January 1979). In addition, the Department of the Interior's comments on the Draft ES/EIR state that use of greater than safe yield of Solano Project water would require an agreement with the present USBR water service contractors on deficiency criteria for critical water supply years. The Solano County Flood Control and Water Conservation District has indicated that this operational concept will not satisfy its water use needs. Its contracts with member units now have an average-year use higher than the firm yield of the Solano Project. The Draft ES/EIR pointed out (page 18, paragraph 3.2.2.3.2) that in the 1980 water year the Solano County Flood Control and Water Conservation District scheduled and received advance payment from its member agencies for delivery of 216,400 acre-feet. This is about 15,000 acre-feet more than the present firm yield of the Solano Project and about 2,000 acre-feet more than the Solano Project yield after adjustment for the reanalysis. This makes it mandatory that they already accept a deficiency in critical water supply years to compensate for contract requirements that exceed present yield. These deficiencies are in addition to present critical year deficiencies, which occur 7 percent of the time and are independent of the reanalysis. The reanalysis will require modification of existing Solano Project water user contracts to accept a third level of deficiency criteria that increase the frequency of critical year deficiencies. The increase would be from 7 percent to 14 percent. In addition, any change in operation could have an adverse effect on recreation opportunities at Lake Berryessa. For these reasons, the Solano Project reanalysis alternative was considered to be unavailable as a substitute for North Bay Aqueduct water supplies.

West Sacramento Valley Canal

Information was added in the Final ES/EIR to clarify that the West Sacramento Valley Canal cannot be realistically considered as a potential water supply to offset expected supplemental water needs. This information includes the facts that Congress has not yet authorized this canal and that the California Water Commission support for this facility would be contingent on resolving fish and wildlife problems at Red Bluff Diversion Dam on the Sacramento River. These problems would be aggravated by the additional diversions. In response to the Draft ES/EIR, the Department of the Interior commented that they have recently completed a concluding report on this project and found that this alternative source of water is highly unlikely in the near future because of a general lack of support. Therefore, the canal would not be available in time to prevent water deficiencies that will occur in Napa and Solano counties.

Ground Water Supply Development

The range of values listed in the Draft ES/EIR for ground water supply development was corrected to be consistent with the Department's October 1980 "Water Action Plan for the Southwest Sacramento Valley Service Area", which used historical records to compute safe yield. This report determined the safe yield of ground water for Solano County based on 10 years of historical record from 1965-75. During this period, local precipitation was average and ground water levels remained fairly constant. This suggested that recharge and withdrawals were equal and that average annual pumping was equivalent to

safe yield. This computed safe yield value was 131,700 acre-feet per year. This value updates the range of 106,000 to 159,700 acre-feet presented in the Draft ES/EIR, which was based on two separate estimates contained in previous studies for which supporting data were not available. Based upon this information, the Department is assuming current ground water pumpage approximates the safe yield. Therefore, the 16,000 acre-feet per year listed in the Draft ES/EIR as a potential additional water supply would not be available and has been omitted as a viable alternative to the North Bay Aqueduct.

Other water supply alternatives are waste water reclamation and conjunctive use of surface and ground water. Following additional review, it has been determined that both of these have a limited potential classification.

Waste Water Reclamation

The wide range of estimates listed in the Draft ES/EIR for waste water reclamation have been restudied by the Department to include all recent information on this subject. The updated values were developed as part of the Department's ongoing reclamation studies, which center on State Water Project service areas. This evaluation computed new values, which are presented in Table 3-5(F). These values represent the projected additional M&I water supplies that could be made available to Solano and Napa counties from waste water reclamation. These updated values replace the estimated range of reclamation supplies listed in the Draft ES/EIR in Table 3-1 on page 14 and in section 3.2.3.2 starting on page 31. Table 3-4(F) shows that even with maximum use of projected waste water reclamation supplies, the North Bay Aqueduct would be needed to meet supplemental M&I water needs for Solano and Napa counties before 1990.

The Department's evaluation of waste water reclamation and projections of supplies from reclamation was done in accordance with Policy 5 of the "Policies and Goals for California Water Management". The Department is committed to this policy for future reclamation and water development activity. This policy states: "Water shall be reclaimed and reused to the maximum extent feasible." The policy further states that the State shall encourage and consider or recommend for funding reclamation projects that meet the following conditions and that do not adversely affect vested water rights, unreasonably impair instream beneficial uses, or place an unreasonable burden on present water supply systems:

- Beneficial use of waste water that would otherwise be discharged to marine or brackish receiving water or evaporation ponds.

- Reclaimed water to replace or supplement fresh water or better quality water.

- Reclaimed water to preserve, restore, or enhance instream beneficial uses that include but are not limited to fish, wildlife, recreation, and esthetics associated with any surface water body or wetlands.

In addition to Water Management Policy, reclamation of waste water is given special attention in the California Water Code. Sections 13550-13551 require

use of reclaimed water for greenbelt irrigation if such water can be delivered at a reasonable cost and is comparable to (or less than) the cost of equivalent potable water. Forfeiture of water rights because of use of reclaimed water is prohibited as stated in the Water Code.

The projections for future reclamation supplies are explained in a Department of Water Resources memorandum, December 30, 1981, "State Water Project Future Supply -- Alameda, Napa, Santa Clara, and Solano County". That memorandum identified a potential of an additional 1,700 acre-feet per year in 1990 and 4,400 acre-feet per year in 2000 for Solano and Napa counties. The projections estimated total waste water production by multiplying population projections by average per capita discharge rates. The amount of future reclaimed supplies was estimated to be a specified percentage of waste water production (beginning at 2 percent in 1990 for Solano and rising to 5 percent in 2000; beginning at 5 percent in 1990 for Napa and rising to 7 percent in 2000). These percentages were based upon a variety of considerations, including a review of ongoing studies and projects, land use patterns, and various factors affecting the use of reclaimed water. These projections are shown in Table 3-5(F).

Studies have not identified any large-scale feasible projects. The most likely large-scale project was one that would deliver waste water from the Fairfield Suisun Wastewater Treatment Plant to the Dally service area. It is discussed in more detail later in this section.

Even though no significant projects are being proposed, it is expected that some will materialize before the year 2000. The projections for Napa and Solano counties considered the fact that the counties have agricultural areas, which can be major users of reclaimed water if located near the sources of reclaimed water. Other factors considered include:

Factors Favoring Reclamation:

1. Increasing demands for water in excess of developed water supplies.

2. A possible higher degree of public acceptance of using waste effluent because of current research studies that may resolve some of the public concerns.

3. Development of more efficient and economical waste water treatment systems that can render the water suitable for reuse.

4. An increasing interest in the use of waste water for landscape irrigation. For example, while the quantity would be small, Caltrans has a high degree of interest in developing the use of waste water for irrigation of highway side and median strips.

5. The increasing cost of water will probably be significant in promoting the recycling of waste water by some high-water use industries.

Factors Adverse to Reclamation:

1. A significant reduction of federal funding for waste water treatment and reclamation projects and a concurrent reduction in State matching funds.

2. Urbanization of agricultural lands on which waste water can and is presently being used.

3. No established health standards that permit use of waste water for ground water recharge projects.

4. Present-day technology has developed greater capability to analyze for toxic materials at very low concentrations, which results in more stringent restrictions on the use of waste water.

The waste water supply that would be available for reclamation in increasing amounts could possibly supplement the North Bay Aqueduct in meeting future M&I demands for Solano and Napa counties if suitable agricultural or industrial supplies now used could be identified to release comparable quantities of fresh water supplies for M&I purposes. Solano and Napa counties are reusing a portion of their waste water supply to meet some water demands. These current reuse supplies have been included in the M&I supply totals for both counties, directly reducing future M&I supplemental water requirements.

In Solano County the total quantity of water now being reused is 3,500 acre-feet per year, which is applied to crop irrigation, industry, and turf farming. The State of California Medical Facility, City of Vacaville Industrial Wastewater Treatment Facility, and Fairfield Suisun Regional Wastewater Treatment Plant have contributed to this reuse effort.

In Napa County the total quantity of water being reused is 500 acre-feet per year. These reuse supplies are being used for golf course irrigation, wildlife habitat, crop irrigation, and landscape irrigation. The Christian Brothers South St. Helena Plant, Napa-Berryessa Resort Improvement District, City of Calistoga, and City of Yountville have contributed to this reuse effort.

In addition to present reuse, investigations are being conducted to increase reuse efforts. The Fairfield Suisun Sewer District has completed several recent studies designed to explore potential uses of reclaimed waste water in Solano County. The objective of these studies was to bring the District into compliance with National Pollution Discharge Elimination System permit requirements that currently prohibit dry weather waste water discharges to Suisun Marsh. One of these studies evaluated a range of potential reclamation and reuse alternatives, including spray irrigation of orchards in Suisun Valley, seasonal irrigation of grazing lands in the Potrero and Montezuma Hills, seasonal irrigation of row crops and grazing land in the Dally area, and development of a freshwater marsh/wetland system near the treatment plant. The alternative of transporting treated waste water to the Dally service area of the Solano Irrigation District was determined to be the most feasible reclamation option and was subsequently studied in greater detail. This analysis indicated that although there were some environmental advantages, the cost of this alternative is high at this time.

Implementation of waste water reclamation projects is complex and requires consideration of many factors. The Department of Water Resources recently estimated preliminary cost data for the proposed Dally Reclamation Project in Solano County. This reclamation project would have involved delivery of waste water from the Fairfield Suisun Wastewater Treatment Plant for agricultural irrigation in the Dally area of the Solano Irrigation District northeast of

Fairfield in exchange for Solano Project water. The unit cost of water for Dally Project alternatives averaged about $750 per acre-foot and had a potential high cost of $1,100 per acre-foot. The following are the most significant reasons for the estimated high cost of water from the Dally Reclamation Project.

- The distance the reclaimed water would have to be transported from the Fairfield Suisun Wastewater Treatment Plant for agricultural use compared to the relatively small amount of water reclaimed.

- The probable required tradeoff of reclaimed waste water for fresh water at a ratio of 2 to 1 or 1-1/2 to 1. This range was suggested as reasonable compensation for the lower quality of the reclaimed water that would be served. The Solano Irrigation District expressed concern that use of reclaimed water in the Dally service area would impair the soil's long-term usefulness for agriculture, and that operating costs for farming would be higher than for using fresh water. However, the District has not agreed that the suggested tradeoff ratio would be adequate to fully compensate for the use of reclaimed water.

- The seasonal use of the reclaimed water. The Dally agricultural area needs irrigation only about five months of the year, resulting in low usage of the pipeline.

No other large-scale projects are in progress or have been identified for Solano and Napa counties.

In addition, the Fairfield Suisun Sewer District and the Department are currently reviewing the possibility of an alternative to the Dally Project for the reuse of effluent from the Fairfield Suisun plant. This alternative would consist of discharging the effluent into Boynton-Cordelia Ditch of the proposed Suisun Marsh Overall Protection Facilities and providing at least a one-to-one dilution ratio. This ratio would be maintained by operating all or part of the Overall Facilities to provide necessary receiving water flows at the point of discharge. This would provide salinity improvements and fish and wildlife benefits that are in addition to the benefits provided by the Overall Facilities. The reduced salinity would provide incidental fish and wildlife benefits during the summer. During fall, winter, and spring months when operation of the Overall Facilities is required to accomplish their primary function of water quality improvement for Marsh management, the discharge of waste water would be a more significant benefit in increasing the effectiveness of the facilities. Thus, such discharge of the effluent would comprise a form of reuse. In the past, the San Francisco Bay Regional Water Quality Control Board has been concerned about discharging such effluent into Suisun Marsh, particularly during summer months. However, the Regional Board has agreed to consider relaxing effluent discharge dilution requirements that would be required to make this alternative feasible. This alternative would be within the financial capability of the Sewer District. Its implementation would remove this source of water from consideration as an alternative M&I supply for Solano and Napa counties. It is estimated that by 2020, discharge from this plant will be roughly 20 percent of the total waste water from cities in the North Bay Aqueduct service area.

The Department supports waste water reclamation and has contributed all or part of the funds for several studies to provide information that could

advance the adaptability of this supply. The Department will continue to fund these investigations in the future. The Department is currently investigating reclamation management for all State Water Project service contractors in accordance with the Governor's Executive Order B-68-80, issued July 1980 and other ongoing studies.

The Department has completed several studies and has others in progress that are reviewing the use of reclaimed supplies for: (1) agricultural irrigation, (2) landscape irrigation, (3) industrial uses, and (4) ground water recharge. Although there are other uses for reclaimed water, they usually are not as significant in terms of volumes of water used or benefits gained. As stated above, the experience Department personnel have gained in these studies is the basis in part for judging the present potential for waste water reclamation in Solano and Napa counties.

The future reclamation activity projected for Solano and Napa counties can cause significant environmental impacts. Reclamation projects can include construction activities, installation of distribution systems, treatment plant improvements, ground water recharge programs, and increased energy use. More specifically, the types of impacts that could be created from reclamation projects are:

° Disruption, displacement, compaction, or over-covering of the soil due to excavation and other construction activities. In addition, these activities could affect cultural resources or local plant and animal life.

° Temporary and long-term local deterioration in air quality from construction activities and population growth supported by the reclaimed supplies of water. This increased growth could also affect land use, public services, utilities, housing, transportation, and noise.

° Changes in ground water volumes and qualities.

° High energy consumption for current methods of treating reclaimed water. These methods include ion exchange and reverse osmosis.

° Crop pattern changes due to changes in the quality of irrigation supplies.

A detailed checklist of impacts is presented in Table 3-19(F).

Conjunctive Use of Surface and Ground Water

Conjunctive use of surface and ground water was shown in the Draft ES/EIR (Chapter 3.0) to have a theoretical potential of 20,000 acre-feet per year of firm supply. However, this alternative was not included in Table 3-1, Water Supply Evaluation Summary, of the Draft ES/EIR and was not considered a viable source of M&I supply for Solano and Napa counties. It should be considered and evaluated as an alternative M&I supply for the North Bay Aqueduct. Conjunctive use was discussed on page 17 of the draft and is not part of the alternative supply listed in Table 3-1 for ground water supply development. Further review of conjunctive use alternative supply determined that the 20,000 acre-foot theoretical value was not well supported, and examination of related data indicated that this alternative has limited potential.

The 20,000 acre-foot value presented in the Draft ES/EIR was the result of a brief reconnaissance level study by the U. S. Bureau of Reclamation. The people who made the estimate are no longer at the Mid-Pacific Regional Office and present USBR staff has no record of the details. It appears that this study did not include a specific operational study of the surface and ground water supplies in question. The Department's additional review involved examination of a USBR operational study of Lake Berryessa to approximate the potential of conjunctive use (see Reference 8, listed in this General Response). Lake Berryessa provided the surface water supply for this conjunctive use review.

Most of the ground water supply that could be managed in conjunction with operation of Lake Berryessa is in northeastern Solano County. Details of the ground water basins in Solano County can be found in DWR Bulletin 118-6, August 1978, which was done in cooperation with the U. S. Geological Survey, and in the USGS Water-Supply Paper 1464, "Geology, Water Resources, and Usable Ground-Water Storage Capacity of Part of Solano County, California", 1960. For more water to be obtained from conjunctive use of these two resources, the unregulated spills and/or drainage leaving the basin would have to be reduced and that reduction used for agricultural irrigation or M&I supply.

In considering the use of spills from Lake Berryessa, the Department analyzed a USBR operational study for that reservoir covering the period 1906 to 1975. The study was based on annual contract demands in the Solano Project of 210,000 acre-feet and releases of 20,000 acre-feet per year to Putah Creek for downstream water rights and percolation to ground water. The possible conjunctive use of surface and ground water was considered under two alternative modes of operation for this historical period:

° The first assumed that the quantities of usable spills from Lake Berryessa would be used when available to replace agricultural applied water deliveries from the Solano Project and that at other times equivalent amounts of water would be supplied by drawing on ground water. This alternative would make replaced agricultural supplies, which now come from Lake Berryessa, available for M&I uses.

° The second assumed that the method of operation would be to increase the draft on Lake Berryessa to create an additional M&I supply during normal and above-normal water supply years. Then in critical water supply years, resulting shortages in agricultural supplies would be offset by drawing on ground water. This is very similar to the Solano Project reanalysis alternative except that ground water would be used to offset deficiencies.

The factors affecting the potential of the first alternative method of conjunctive operation include:

° The necessity to substantially increase the size of the Putah-South Canal.

° The cost of expanding the Solano Irrigation District distribution system to provide surface agricultural supplies to areas now serviced from ground water.

° Ceiling on divertable quantities because spills could not be anticipated.

° Uncertainties in ground water basin recharge characteristics.

The factors affecting the potential of the second method of conjunctive operation include:

° The cost of installing about 535 wells that would be required if individual pumps and wells could supply an average of 500 gallons per minute. This cost was estimated to be $24 million.

° Uncertainties in ground water basin recharge characteristics.

These alternative methods of using portions of the spills from Lake Berryessa based on the USBR operational study would result in additional supplies from conjunctive use of surface and ground water amounting to 30 to 50 percent less than the 20,000 acre-feet estimate made by the USBR. The Department believes that the second alternative procedure would be the better of the two because it is a more practical method of operation for a conjunctive use program. It was estimated from the USBR operational study results for the critical period from 1916 through 1934 that 9,900 acre-feet of additional supply from conjunctive use of surface and ground water could be realized. However, the projected supplemental applied water needs for agriculture in Solano County would probably affect the availability of this 9,900 acre-feet for M&I purposes because this supply of 9,900 acre-feet would probably first be used to meet future agricultural requirements.

The Department reviewed the agricultural supply, demand, and supplemental applied water needs for Solano County and found that values presented in the Draft ES/EIR were not consistent with information presented in M&I uses and supplies, which was obtained from the Department's "Water Action Plan for the Southwest Sacramento Valley Service Area". The Draft ES/EIR indicated that 26,700 acre-feet of agricultural supplemental applied water would be needed in the year 2000. Based on the Water Action Plan, the total supplemental requirements were reduced to 18,100 acre-feet in 1990 and to 21,600 acre-feet in 2000 (see Section 3). Also, to be consistent with the Water Action Plan, the 4,000-acre-feet estimate in the Draft ES/EIR for potential reuse of agricultural drainage water was corrected to 14,000 acre-feet. Based on these corrected values, the adjusted agricultural supplemental water requirements that would remain after reuse of agricultural drainage water are 4,100 acre-feet in 1990 and 7,600 acre-feet in 2000 (see Table 3-6(F)).

Any potential increase in supply from conjunctive use or waste water reclamation would probably first be used to meet these remaining agricultural supplemental water needs because of need and the current access to these new supplies. The limited yield from conjunctive use in excess of this agricultural need could then be used for M&I purposes. These residual conjunctive use yields would be 5,800 acre-feet in 1990 and 2,300 acre-feet in 2000. These reduced values are shown in Table 3-2(F). This table summarizes the potential alternative water supplies that could be used to meet M&I demands in Solano and Napa counties.

The environmental impacts that could occur from development of conjunctive use are similar to those described for waste water reclamation projects for the

categories of construction activities, installation of wells and distribution systems, ground water use, and increased energy use. Energy use impacts for conjunctive use development is related to ground water pumping. Potential impact categories are:

° Soil
° Local plant and animal life
° Cultural resources
° Land use
° Population
° Public services
° Utilities
° Air
° Housing
° Transportation
° Noise
° Crop patterns
° Energy use

A detailed checklist of impacts is presented in Table 3-20(F).

Urban Water Conservation and Supplemental M&I Needs

The Department's review of the Draft ES/EIR included updating the M&I demand and supplemental water requirements for Solano and Napa counties (see Table 3-3(F)). The new demand values were computed using:

° New E-150 1980 census information.

° Updated per capita use rates based on recent water use information as supplied by local water agencies.

° New water savings resulting from updated urban water conservation draft plans for Solano and Napa counties.

The new M&I demand values were computed with and without urban water conservation measures. The new M&I supplemental water requirements were computed using the M&I supply values presented in the Draft ES/EIR, which are consistent with the Department's "Water Action Plan for the Southwest Sacramento Valley Service Area".

The updated population values, when compared to previous projections, showed that the combined total population projections for Solano and Napa counties increased by 12 percent in 1990 and 7 percent in 2000. The updated population values showed Solano County increasing by 25 percent in 1990 and 21 percent in 2000. Napa County decreased 16 percent in 1990 and 25 percent in 2000. These new population values are shown in Table 6-2(F).

The most current per capita use rates of water supply in Solano and Napa counties are listed below. These rates are based on 1980 water use totals. These rates (presented as gallons per capita per day) include industrial and commercial use and none of the total urban water conservation measures developed for the Final ES/EIR. These values were used to compute M&I demands

without urban water conservation. Total conservation savings were applied to compute demands with conservation. These total savings include mandatory conservation measures, conservation trends, and measures included in the specific conservation plans for Solano and Napa counties and are described later in this section.

Solano County	
Suisun City	550
Vallejo	170
Fairfield	250
Vacaville	178
Benicia	175
Remainder	175

Napa County	
Yountville	213
American Canyon Water Agency	150
Calistoga	192
Napa	213
Remainder	213

Municipal and industrial conservation can provide water savings in Solano and Napa counties and important mitigation for fishery impacts by reducing diversions. The Department of Water Resources has developed draft water conservation plans for these counties that incorporate measures currently implemented in the North Bay Aqueduct service area and add new measures suited to the character and needs of the service area. Development of these plans was done for the Final ES/EIR. These plans include possible measures for the cities in both counties and for the water agency in Napa County. The draft urban water conservation plans focus on education and public relations measures, water management measures, and regulations for efficient water use in new and existing developments. The possible urban water conservation measures used for these plans are described in Appendix I. The draft plans are presented in Appendix II for Solano County Flood Control and Water Conservation District and in Appendix III for Napa County Flood Control and Water Conservation District. Supporting information on projected water savings is attached to each plan. Total urban water conservation savings for Solano and Napa counties was computed using these plans plus urban water conservation from mandatory measures and future trends in the use of water-saving type appliances and replacement devices. The urban water conservation measures included in these plans pertain to the categories listed below.

Education and Public Relations:

° Local Water Conservation Advisory Committee

° Conservation Literature, such as:

General Water Conservation Brochure
Landscape Water Conservation Brochure with Plant List
Conservation Brochures for Specific Water Users

° Previous Year's Use on Water Bills

- Advertising and Promotional Campaigns, such as:

    General Activities
    Public Speaking Presentations
    Demonstration Low-Water-Using Landscapes
    Promotional Campaigns with Nurseries
    Awards for Conservation Developments

- Work with Large Water Users

- In-School Education

- Information on Federal and State Water Conservation Laws, Programs, and Sanctions, which are:

    Water Conservation Laws
    State Tax Credit

Water Management Programs:

- Techniques for Reduction of Water Loss, such as:

    Systemwide Water Audit
    Leak Detection Program
    Meter Maintenance and Calibration Program
    Corrosion Control Program
    Valve Exercising Program
    Accounting for Unmetered Water Use

- Meter Uses

- Device Distribution by Mass Mailing Techniques

- Equipment Loan Program for Large Water Users

- Study Pricing

Use of Regulations:

- Water Waste Ordinance

- Water Conservation Ordinances, such as:

    Requirements for Large Water Users
    Self-Closing Faucets
    Low-Water-Using Landscapes
    Meters

- Reduction in Water System Connection Fee for Conservation Developments

To develop these draft urban water conservation plans, the Department of Water Resources contacted city officials in Solano and Napa counties to obtain specific and recent information. This information was collected after publication of the Draft ES/EIR. This new information was used to develop possible conservation measures that do not raise insurmountable social, economic, or institutional problems. The total urban water conservation measures for the Final ES/EIR develops a total annual savings in the year 2000 of 20,300 acre-feet for both Solano and Napa counties. Urban water conservation savings are summarized in Table 3-7(F), Table 3-8(F), and Table 3-9(F). The two-county total annual savings for the urban water conservation measures presented in the Draft ES/EIR was 20,531 acre-feet in the year 2000. This previous estimate is shown in Table 3-10, page 32 of the Draft ES/EIR. The difference in total urban water conservation savings between the Draft and the Final ES/EIR is about 1 percent in annual savings.

Water conservation measures contained but not recommended in the plans for Solano and Napa counties are listed below, with an explanation of why the measures were not appropriate for the plans.

° Requiring pressure regulators to not exceed a certain psi. There is little information available on whether pressure regulators conserve water and if so, how much they conserve. So far, information has not shown that the measure is cost effective since savings are judged to be small at best, particularly if the water savings devices recommended in the plan for the interior of the house (which are considered cost effective) are installed.

° Requiring temperature compensating mixing valves or shower cutoff valves in new developments. These devices are not recommended because the water savings resulting from the currently required low-flow showerhead leaves little additional savings possible from the mixing valve or cutoff valve to justify additional regulations.

° Requiring water conservation displays. Because of the high costs to construct, transport, maintain, and staff displays, it is recommended that agencies distribute literature and make presentations at fairs and conferences instead. The recommended alternative is judged to be more cost effective since both measures get a similar message to the public.

° Constructing a demonstration low water-using landscape. It is recommended that agencies locate existing low water-using landscapes that can serve as demonstration landscapes. Because of the large costs for staff time and materials that would be required for each landscape, it is not recommended that agencies construct and maintain new demonstration landscapes if examples exist in their service area. Construction of demonstration landscapes is recommended for agencies that do not have existing low water-using landscapes in their service area.

° Water-conserving landscapes required in new single-family homes. A landscape ordinance is being recommended that will affect all new landscapes except single-family homes. This is because all new landscapes except at single-family homes are reviewed by local planning agencies. Enforcement for single-family home landscapes would require a major change in the existing planning process since no approval is currently required for

single-family home landscaping and because of a major increase in staff costs. It would also require homeowners to accept the fact that they could not plant what they wanted in their own homes.

° Expanded leak detection and repair and education programs, water meters. There is insufficient information to determine what, if any savings are obtainable from such programs.

° Free installation of water-saving devices. The plan recommends that agencies conduct a mass mailing distribution program initially and conduct a follow-up every fifth year with a kit request program. A free installation program has higher staff costs, but it is normally cost effective. A free installation program was not included in the plan because of agency concerns regarding increased liability problems associated with work in customers' homes and its potential for increased cost and bad publicity for conservation programs.

° Requiring water conservation customer audits upon request. This measure is not recommended because the information a customer can gain from a home audit is just as easily understood through brochures and other forms of literature and it is not shown to be cost effective. If a free installation program is implemented, however, an audit could be conducted at the same time.

° Installation of toilet dams. There are toilet dams that are more efficient than the bags included in the water saving device kit. However, the bags were chosen instead of the dams because dams are more expensive and it is more difficult to send them through the mail. They are also more likely to malfunction.

° Ultra-low flush toilet systems. Toilet dams are close in efficiency to the best approved low flush method. Since they are less expensive, there is little or no advantage to using the ultra-low flush toilet system over the toilet dams.

° Required retrofit of water savings devices at time of sale of old home. It is expected that most shower heads and faucets will be replaced in any event by the year 2000. The plan will recommend that new customers receive a notice informing them of the availability of the water savings devices.

° Free landscaping design. This measure appears to be cost effective. It is not recommended in the plan because it was thought to be too much of an interference with private enterprise. In addition, the plan is based on cooperation of nurseries and landscape architects and such a measure could alienate them.

The preferred alternative for the Final ES/EIR has been modified to assure implementation of urban water conservation programs. The preferred alternative now includes the North Bay Aqueduct plus a water conservation program that will be implemented through enforceable institutional means. These programs could include goals or specific conservation measures and will be reasonable, practical, and economically achievable. The draft urban water

conservation plans are being reviewed in current negotiations being conducted between the Department of Water Resources and North Bay Aqueduct contracting agencies. The water savings for urban water conservation described in this section could be the framework for the goals of a water conservation program. The conservation programs will not reduce the maximum North Bay Aqueduct annual contracted entitlements. These programs will extend contract entitlement buildup further into the future. Until the maximum entitlement deliveries time is reached, water conservation will delay annual diversion increases for the North Bay Aqueduct and provide important mitigation for fishery impacts at the diversion.

In addition to the urban water conservation plans for Solano and Napa counties, the Department investigated M&I water savings from mandatory measures and from trends toward urban water conservation. Mandatory measures include State laws pertaining to new construction requiring pipe insulation and lower-water-use toilets, showers and faucets. Trends toward conservation show that additional water savings will occur from replacement of shower heads in older construction with more efficient fixtures and from availability of new water-efficient appliances such as dishwashers and clothes washers.

The total projected annual water savings for all urban water conservation measures for Solano and Napa counties is 9,700 acre-feet per year in 1990 and 20,300 acre-feet per year in 2000. The projected annual water savings from the conservation plans for both counties is 4,500 acre-feet in 1990 and 9,900 acre-feet in 2000. Mandatory conservation measures will produce annual water savings of 3,500 acre-feet in 1990 and 6,300 acre-feet in 2000. Annual savings due to trends will be 1,700 acre-feet in 1990 and 4,100 acre-feet in 2000. More specific information concerning water savings from conservation measures is listed in Tables 3-7(F), 3-8(F), 3-9(F), 3-10(F), 3-11(F), and 3-15(F) and in the supporting information following each urban conservation plan in Appendices II and III. These tables update information presented on pages 19 to 32 in the Draft ES/EIR.

The estimated additional costs and staff time associated with the urban water conservation plans are presented in Tables 3-12(F), 3-13(F), 3-14(F), 3-16(F), 3-17(F), and 3-18(F). The estimated annual cost for both counties in 1990 is $260,000 and in 2000 is $275,000.

Water savings from conservation can reduce charges for the North Bay Aqueduct. The 30 contractors for State Water Project (SWP) water pay all costs incurred in developing and delivering the water supply. The charges that the contractors pay to defray all costs of the SWP are divided into two major groups, the Delta Water Charge and the Transportation Charge.

The Delta Water Charge is essentially a charge to repay the reimbursable costs of those features of the SWP that develop a water supply and conserve it for use by the contractors, including interest on capital expenditures. This is an average (melded) cost of all facilities that develop supply. The annual Delta water costs for the North Bay Aqueduct (NBA) contracted water over the period of entitlement buildup are estimated to range from $1,000,000 in 1986 to $2,700,000 at time of full entitlement. Delta Water Rates (cost per acre-foot) are estimated in Bulletin 132-81 to be $30 in 1982, increase to $50 by 1990, and then remain constant to 2035. The incremental (marginal) cost to

develop new conservation facilities is $200 per acre-foot, as cited on page 30 of DWR Bulletin 76-81.

The Transportation Charge is paid by each SWP contractor to repay the allocated share of the cost of transportation facilities used to deliver its water supply. The Transportation Charge is divided into three parts: the capital cost component, the minimum operation, maintenance, power, and replacement component, and the variable operations maintenance power and replacement component. The Transportation Charge is an incremental (marginal) cost. The annual transportation costs for the North Bay Aqueduct over the period of entitlement buildup are estimated to range from $3,200,000 in 1986 to $4,700,000 at full entitlement. Transportation costs are estimated to range from 70 percent in 1986 to 40 percent at full entitlement of total NBA charges. Interest on bonded indebtedness incurred for capital costs is included in the transportation charge.

Based on DWR Bulletin 132-81 existing Table A contract entitlement amounts, the total cost per acre-foot of water is:

Solano County Flood Control and Water Conservation District --

1986 $168/acre-foot 2000 $103/acre-foot

Napa County Flood Control and Water Conservation District --

1986 $424/acre-foot 2000 $257/acre-foot

Estimates of cost savings for the water delivered from the North Bay Aqueduct are being reviewed in current negotiations for the urban water conservation contract amendments. This review is considering contract negotiations. Schedules of annual entitlement deliveries are being reviewed to determine necessary changes due to: (1) demand buildup changes from those estimated when the original contracts were signed, and (2) water savings from the water conservation plans. These changes will extend the contracted annual entitlement buildup schedules. This will reduce the SWP Delta Water Charge to each of the two contractors during the demand buildup. In addition, the SWP Variable Operation, Maintenance, Power, and Replacement component of the Transportation Charges to each contractor will be reduced due to lesser quantities of water being pumped with the water conservation plans in effect. These adjustments will reduce the cost of North Bay Aqueduct water to the customer. Preliminary estimates done for Napa County Flood Control and Water Conservation District show that their unit water costs can be reduced by about $65 per acre-foot in 1986 and $45 per acre-foot in 2000 due to contract entitlement delays.

The cost of implementing the water conservation measures is outlined in Tables 3-12(F) and 3-16(F). These costs could be reduced by nonproject funding from sources such as the Renewable Resources Investment Fund and funds from the State Water Resources Control Board for projects that qualify for this conservation program. In allocating these nonproject funds, North Bay Aqueduct conservation plans will be given a first priority to the extent that Department of Water Resources has the authority to determine priorities. The combination of nonproject funding sources with annual savings due to entitlement extensions can significantly offset the costs associated with implementation of the conservation programs. Project funds can also be used to finance costs of the conservation programs.

Savings for the urban water conservation measures addressed in the Final ES/EIR are estimated to be significant. A listing of the incremental savings per capita (presented as gallons per capita per day) for conservation measures from the plans, mandatory laws, and trends is shown below.

Solano County	1990	2000	Napa County	1990	2000
Suisun City	64	126	Yountville	18	32
Vallejo	17	29	American Canyon Water Agency	22	32
Fairfield	21	36	Calistoga	29	45
Vacaville	25	39	Napa	16	31
Benicia	24	37	Remainder	5	11
Remainder	13	20			

Summary

The new M&I demand, supply, and supplemental water requirements are also shown in Table 3-3(F). These values update Table 3-2 of the Draft ES/EIR. The new M&I supply figures have been increased by about 3,000 acre-feet per year to reflect some of the water reclamation activity currently in effect that was not considered as supply in the Draft ES/EIR. The updated supplemental water requirements for Solano and Napa counties are projected to be 11,400 acre-feet in 1990 and 20,700 acre-feet in 2000.

Both the maximum and probable potential for water supply alternatives accepted by the Department of Water Resources to supplement North Bay Aqueduct have been summarized in Table 3-4(F). This table shows that Solano and Napa counties would have a deficiency of 3,900 acre-feet per year in M&I supplies in the year 1990 even if the maximum potential of these alternatives is developed and the aqueduct is not constructed. Table 3-4(F) also confirms that a combination of these alternatives without the North Bay Aqueduct could not be used as an independent alternative in the Final ES/EIR.

Table 3-1(F)

INVESTIGATED ALTERNATIVE WATER SUPPLIES 1/
FOR SOLANO AND NAPA COUNTIES
(Acre-Feet per Year)

ALTERNATIVE	1990	2000	Potential		
			None	Limited	High
North Bay Aqueduct	67,000	67,000			X
Desalination of Suisun Slough		25,000	X		
Solano Project Reanalysis		13,000	X		
West Sacramento Valley Canal		155,500	X		
Ground Water a. Development of additional long term firm yield	0	0	X		
b. conjunctive use	9,900	9,900		X	
Waste Water Reclamation	1,700	4,400		X	

1/ Water conservation is considered separately.

Table 3-2(F)

POTENTIAL ALTERNATIVE WATER SUPPLIES TO MEET M&I DEMAND
FOR SOLANO AND NAPA COUNTIES
(Acre-Feet per Year)

ALTERNATIVE	1990	2000	Comment
North Bay Aqueduct	67,000	67,000	Firm supply demonstrated
Conjunctive Use of Surface and Ground Water 1/	5,800	2,300	Lake Berryessa surface water; Solano County ground water; infrequent use of over 500 wells and unknown basin recharge characteristics
Waste Water Reclamation	1,700	4,400	High transportation cost to place of use

1/ Values are adjusted to first meet the projected agricultural supplemental applied water requirements for Solano County.

Table 3-3(F)

PROJECTED SUPPLY, DEMAND, AND SUPPLEMENTAL WATER REQUIREMENTS
FOR SOLANO AND NAPA COUNTIES
(Acre-Feet per Year)

	Demand 1/ Without Water 3/ Conservation	Water Conservation Potential	Demand With Water 2/ Conservation	4/ Supply	Supplemental Water Requirement
Solano Co					
1990	75,500	8,200	67,300	58,900	8,400
2000	93,900	17,100	76,800	58,900	17,900
Napa Co					
1990	22,700	1,500	21,200	18,200	3,000
2000	24,200	3,200	21,000	18,200	2,800
Total Both Counties					
1990	98,200	9,700	88,500	77,100	11,400
2000	118,100	20,300	97,800	77,100	20,700

1/ Demand, adjusted Water Action Plan (W.A.P.) with new E-150 1980 Census and new per capita use rates.

2/ Values from W.A.P.

3/ Conservation includes mandated (laws), trends, and conservation plan.

4/ Values from W.A.P. with adjustments to reflect increases in current reclamation use which can be substituted for M&I use.

Table 3-4(F)

MAXIMUM AND PROBABLE POTENTIAL FOR WATER SUPPLY ALTERNATIVES
TO SUPPLEMENT NORTH BAY AQUEDUCT M&I WATER DELIVERIES
TO SOLANO AND NAPA COUNTIES
(Acre-Feet per Year)

Mixed Supply Sources	Maximum Potential		Probable Potential	
	1990	2000	1990	2000
Conjunctive Use of Ground Water 1/	5,800	2,300	0	0
Waste Water Reclamation	1,700	4,400	0	0
North Bay Aqueduct requirements needed to offset deficiencies	3,900	14,000	11,400	20,700
Total Solano and Napa Supplemental M&I Water Requirements 2/	11,400	20,700	11,400	20,700

1/ Includes adjustment for Solano County projected agricultural applied water requirements.

2/ Includes Urban Conservation Measures, values from Table 3-3 (F).

Table 3-5(F)

PRESENT AND PROJECTED ADDITIONAL WASTE WATER VOLUMES
FOR SOLANO AND NAPA COUNTIES
(Acre-Feet per Year)

	1979 Current		1990 Additional		2000 Additional	
	Production	Reclamation	Production	Reclamation	Production	Reclamation
Napa	11,600	500	3,200	700	6,200	1,200
Solano	36,600	3,500	13,200	1,000	27,000	3,200
Total	48,200	4,000	16,400	1,700	33,200	4,400

Table 3-6(F)

PROJECTED TOTAL AND ADJUSTED
AGRICULTURAL SUPPLEMENTAL APPLIED WATER REQUIREMENTS CONSIDERING
POTENTIAL SUPPLIES FROM REUSE OF AGRICULTURAL DRAINAGE WATER
(Acre-Feet per Year)

	1990	2000
Supplemental Agricultural Requirement	18,100	21,600
Potential Reuse	14,000	14,000
Adjusted Supplemental Agricultural Requirement	4,100	7,600

Table 3-7(F)

PROJECTED TOTAL
URBAN WATER CONSERVATION POTENTIAL
FOR SOLANO AND NAPA COUNTIES
(Acre-Feet per Year)

	1990	2000
Solano County	8,200	17,100
Napa County	1,500	3,200
Total Both Counties	9,700	20,300

Table 3-8(F)

PROJECTED WATER SAVINGS RESULTING FROM
URBAN WATER CONSERVATION PLANS
FOR SOLANO AND NAPA COUNTIES
(Acre-Feet per Year)

	1990	2000
Solano County	3,700	8,300
Napa County	800	1,600
Total Both Counties	4,500	9,900

Table 3-9(F)

PROJECTED RESULTS OF MANDATORY URBAN WATER CONSERVATION1/
FOR SOLANO AND NAPA COUNTIES
(Acre-Feet per Year)

	1990	2000
Solano County	3,200	5,800
Napa County	300	500
Total Both Counties	3,500	6,300

1/ State laws for low water use for new construction.

Table 3-10(F)

PROJECTED URBAN WATER CONSERVATION DUE TO TRENDS1/
FOR SOLANO AND NAPA COUNTIES
(Acre-Feet per Year)

	1990	2000
Solano County	1,300	3,000
Napa County	400	1,100
Total Both Counties	1,700	4,100

1/ Represents the reduction for the availability of low water use appliances and the replacement of high water use showers in older homes with more efficient ones.

Table 3-11(F)

SUMMARY OF PROJECTED URBAN WATER CONSERVATION
FOR BENICIA, FAIRFIELD, VACAVILLE, VALLEJO, AND SUISUN CITY
SOLANO COUNTY
(Thousand Gallons per Day)

Laws	1990	2000
Benicia	285.2	381.5
Fairfield	443.2	697.9
Vacaville	1,117.5	2,082.8
Vallejo	485.6	832.7
Suisun City	72.1	151.2
Remainder	473.1	1,002.6
Solano Co. Subtotal	2,876.7	5,148.7
AF/yr	3,223	5,768
Trends		
Benicia	84.4	186.2
Fairfield	210.3	504.9
Vacaville	250.1	576.5
Vallejo	378.6	940.6
Suisun City	48.8	127.7
Remainder	151.6	369.2
Solano Co. Subtotal	1,123.8	2,705.1
AF/yr	1,259	3,030
Conservation Plan		
Benicia	271.5	553.3
Fairfield	647.7	1,349.1
Vacaville	720.2	2,026.3
Vallejo	931.3	1,698.8
Suisun City	744.9	1,747.9
Solano Co. Subtotal	3,315.6	7,375.4
AF/yr	3,714	8,262
Solano Co. Total	7,316.1	15,229.2
AF/yr	8,196	17,060

Table 3-12(F)

ESTIMATED ADDITIONAL COSTS 1/
URBAN WATER CONSERVATION PLAN
SOLANO COUNTY
(Thousand Dollars)

	Solano Co.	Vallejo	Farifield	Vacaville	Benicia	Suisun City	TOTAL
Education and Public Relations							
1st Year	19.8	12.9	5.8	5.3	3.6	2.9	50.3
2nd Year	18.1	12.9	5.8	5.3	3.6	2.9	48.6
3rd Year	18.1	12.9	5.8	5.3	3.6	2.9	48.6
4th Year	16.1	12.9	5.8	5.3	3.6	2.9	46.6
1990	21.0	16.0	7.8	9.3	4.9	3.1	62.1
2000	21.7	17.9	8.9	13.1	5.7	3.5	70.8
2010	22.7	19.5	9.7	16.5	6.5	4.0	78.9
Water Management Measures 2/3/							
1st Year	0	26.3	18.4	26.1	22.1	22.5	115.4
2nd Year	30.0	34.8	10.2	9.3	73.3	72.5	230.1
3rd Year	7.9	20.4	3.0	3.3	13.4	13.0	61.0
1990	7.9	25.8	3.0	3.3	15.2	13.0	68.2
2000	7.9	28.5	3.0	3.3	16.7	13.3	72.7
2010	7.9	30.9	3.0	3.3	17.6	13.9	76.6
Regulations							
1st Year	0	0	0	0	0	0	0
2nd Year	5.0	13.4	10.8	10.7	6.6	6.0	52.5
3rd Year	0	11.9	9.3	9.2	5.1	4.5	40.0
1990	0	12.0	9.3	9.4	5.2	4.5	40.4
2000	0	12.1	9.4	9.6	5.2	4.5	40.8
2010	0	12.1	9.4	9.7	5.2	4.5	40.9
Total							
1st Year	19.8	39.2	24.2	31.4	25.7	25.4	165.7
2nd Year	53.1	61.1	26.8	25.3	83.5	81.4	331.2
3rd Year	26.0	45.2	18.1	17.8	22.1	20.4	149.6
4th Year	24.0	45.2	18.1	17.8	22.1	20.4	147.6
1990	28.9	53.8	20.1	22.0	25.3	20.6	170.7
2000	29.6	58.5	21.3	26.0	27.6	21.3	184.3
2010	30.6	62.5	22.1	29.5	29.3	22.4	196.4

1/ Does not include costs of existing measures.
2/ Does not include costs for implementing meter maintenance or corrosion control.
3/ Device program implemented on 5 year cycle, but converted to annual cost in 3rd year and thereafter.

Table 3-13(F)

ESTIMATED ADDITIONAL STAFF TIME 1,2/
URBAN WATER CONSERVATION PLAN
SOLANO COUNTY
(Person Weeks)

STAFF	Solano Co.	Vallejo	Fairfield	Vacaville	Benicia	Suisun City	TOTAL
Public Information Staff							
1st Year	23	4	4	4	5	3	43
2nd Year	48	12	10	10	7	8	95
3rd Year	33	5	5	5	4	6	58
4th Year and Thereafter	30	5	5	5	4	6	55
Field Staff							
1st Year	0	8	2	8	8	8	34
2nd Year	0	40	10	11	114	116	291
3rd Year	0	40	10	11	25	25	137
4th Year	0	40	10	11	25	25	137
5th Year and Thereafter	0	40	10	11	25	25	137
Technical Staff							
1st Year	2	14	10	14	14	14	68
2nd Year	3	2	2	2	1	1	11
3rd Year and Thereafter	1	2	2	2	1	1	9
Planning Staff							
1st Year	0	0	0	0	0	0	0
2nd Year and Thereafter	0	4	4	4	3	2	17

1/ Does not include staff for implementing meter maintenance and corrosion control programs.
2/ Fractions are rounded up to the nearest week.

Table 3-14(F)

VARIABLE COSTS
SOLANO COUNTY
(Dollars per Year)

CONSERVATION LITERATURE	1990	2000
Brochure		
Vallejo	9,600	10,900
Benicia	2,300	2,900
Fairfield	5,800	6,900
Suisun City	1,100	1,400
Vacaville	7,300	11,100
Mailing		
Vallejo	4,400	5,000
Benicia	1,100	1,300
Suisun City	500	600
IN SCHOOL		
Materials		
Solano County	3,700	4,400
VALVE EXERCISE (ASSUME 1 VALVE PER 6 HOUSEHOLDS)		
Vallejo	20,400	23,100
Benicia	4,800	6,300
Suisun City	2,700	3,000
WATER WASTE ORDINANCE		
Materials		
Vallejo	400	500
Benicia	100	100
Fairfield	200	300
Vacaville	300	500

Table 3-15(F)

SUMMARY OF PROJECTED URBAN WATER CONSERVATION
FOR NAPA, AMERICAN CANYON, YOUNTVILLE, AND CALISTOGA
NAPA COUNTY
(Thousand Gallons per Day)

Laws	1990	2000
Napa	39.4	165.3
American Canyon	88.0	93.9
Yountville	1.2	7.3
Calistoga	81.4	112.8
Remainder of Co.	47.4	59.8
Napa Co. Subtotal	257.4	439.1
AF/yr	288	492
Trends		
Napa	191.1	500.1
American Canyon	29.9	64.2
Yountville	5.7	4.9
Calistoga	21.7	47.1
Remainder of Co.	139.5	355.3
Napa Co. Subtotal	387.9	971.6
AF/yr	434	1,088
Conservation Plan		
Napa	536.0	1,012.6
American Conyon	86.7	146.7
Yountville	19.4	41.3
Calistoga	97.0	207.8
Napa Co. Subtotal	739.1	1,408.4
AF/yr	828	1,577
Napa Co. Total	1,384.4	2,819.1
AF/yr	1,551	3,157

Table 3-16(F)

ESTIMATED ADDITIONAL COSTS 1/
URBAN WATER CONSERVATION PLAN
NAPA COUNTY
(Thousand Dollars)

	Napa Co.	Napa	American Canyon	Calistoga 2/	Yountville 2/	TOTAL
Education and Public Relations						
1st Year	16.1	8.8	2.0	1.2	1.7	29.8
2nd Year	15.4	8.8	2.0	1.2	1.7	29.1
3rd Year	15.4	8.8	2.0	1.2	1.7	29.1
4th Year	13.4	8.8	2.0	1.2	1.7	27.1
1990	13.4	9.1	2.4	1.4	1.7	28.0
2000	13.5	9.7	2.4	1.5	1.7	28.8
2010	13.5	10.3	2.5	1.5	1.7	29.5
Water Management Measures 3/4/						
1st Year	0	26.3	17.9	14.6	17.9	76.7
2nd Year	13.7	89.2	3.3	8.3	3.4	117.9
3rd Year	4.7	78.1	2.1	3.1	1.8	89.8
4th Year	4.7	78.1	2.1	3.1	1.8	89.8
5th Year	4.7	30.1	2.1	3.1	1.8	41.8
1990	4.7	30.4	3.2	3.8	1.8	43.9
2000	4.7	31.3	3.2	4.2	1.8	45.2
2010	4.7	31.9	3.2	4.3	1.8	45.9
Regulations						
1st Year	0	0	0	0	0	0
2nd Year	3.5	10.4	4.4	.7	3.1	22.1
3rd Year	0	8.9	3.6	.4	2.3	15.2
1990	0	8.9	3.6	.4	2.3	15.2
2000	0	8.9	3.6	.4	2.3	15.2
2010	0	8.9	3.6	.4	2.3	15.2
Total						
1st Year	16.1	35.1	19.9	15.8	19.6	106.5
2nd Year	32.6	108.4	9.7	10.2	8.2	169.1
3rd Year	20.1	95.8	7.7	4.7	5.8	134.1
4th Year	18.1	95.8	7.7	4.7	5.8	132.1
5th Year	18.1	47.8	7.7	4.7	5.8	84.1
1990	18.1	48.4	9.2	5.6	5.8	87.1
2000	18.2	49.9	9.2	6.1	5.8	89.2
2010	18.2	51.1	9.3	6.2	5.8	90.6

1/ Does not include cost of existing measures.
2/ Potential SWP contractors through exchange.
3/ Does not include costs for implementing meter maintenance or corrosion control.
4/ Device program implemented on 5 year cycle, but converted to annual cost in 3rd year and thereafter.

Table 3-17(F)

ESTIMATED ADDITIONAL STAFF TIME 1,2/
URBAN WATER CONSERVATION PLAN
NAPA COUNTY
(Person Weeks)

STAFF	Napa Co.	Napa	American Canyon	Calistoga 3/	Yountville 3/	TOTAL
Public Information Staff						
1st Year	20	4	3	2	3	32
2nd Year	37	10	6	4	6	63
3rd Year	30	5	4	3	4	46
4th Year and Thereafter	27	5	4	3	4	43
Field Staff						
1st Year	0	8	4	2	4	18
2nd Year	0	129	6	3	4	142
3rd Year	0	129	6	3	4	142
4th Year	0	129	6	3	4	142
5th Year and Thereafter	0	49	6	3	4	62
Technical Staff						
1st Year	2	12	10	8	10	42
2nd Year	3	2	1	1	1	8
3rd Year and Thereafter	1	2	1	1	1	6
Planning Staff						
1st Year	0	0	0	0	0	0
2nd Year and Thereafter	0	4	2	0	1	7

1/ Does not include staff for implementing meter maintenance and corrosion control programs.
2/ Fractions of person-weeks are rounded up to nearest whole week.
3/ Potential SWP contractors through exchange.

Table 3-18(F)

VARIABLE COSTS
NAPA COUNTY
(Dollars per Year)

CONSERVATION LITERATURE	1990	2000
Brochure		
Yountville	200	200
American Canyon	900	900
Napa	4,900	5,300
Calistoga	400	500
Mailing		
Napa	2,200	2,400
IN SCHOOL		
Materials		
Napa County	800	900
VALVE EXERCISE (ASSUME 1 VALVE PER 6 HOUSEHOLDS)		
Napa	10,200	11,100
American Canyon	2,000	2,000
Calistoga	1,600	2,000
WATER WASTE ORDINANCE		
Materials		
Napa	200	200

Table 3-19(F)
WASTE WATER RECLAMATION
SUMMARY OF ENVIRONMENTAL IMPACTS

	YES	MAYBE	NO
1. Earth. Will the proposal result in:			
a. Unstable earth conditions or in changes in geologic substructures?			X
b. Disruptions, displacements, compaction or overcovering of the soil?	X		
c. Change in topography or ground surface relief features?		X	
d. The destruction, covering or modification of any unique geologic or physical features?			X
e. Any increase in wind or water erosion of soils, either on or off the site?		X	
f. Changes in deposition or erosion of beach sands, or changes in siltation, deposition or erosion which may modify the channel of a river or stream or the bed of the ocean or any bay, inlet or lake?			X
g. Exposure of people or property to geologic hazards such as earthquakes, landslides, mudslides, ground failure, or similar hazards?			X
2. Air. Will the proposal result in:			
a. Substantial air emissions or deterioration of ambient air quality?		X	
b. The creation of objectionable odors?		X	
c. Alteration of air movement, moisture or temperature, or any change in climate, either locally or regionally?			X
3. Water. Will the proposal result in:			
a. Changes in currents, or the course or direction of water movements, in either marine or fresh waters?			X
b. Changes in absorption rates, drainage patterns or the rate and amount of surface water runoff?		X	
c. Alterations to the course or flow of flood waters?			X
d. Change in the amount of surface water in any water body?			X
e. Discharge into surface waters, or in any alteration of surface water quality, including but not limited to temperature, dissolved oxygen or turbidity?		X	
f. Alteration of the direction or rate of flow of ground waters?			X
g. Change in the quantity of ground waters, either through direct additions or withdrawals, or through interception of an aquifer by cuts or excavations?		X	
h. Substantial reduction in the amount of water otherwise available for public water supplies?			X
i. Exposure of people or property to water related hazards such as flooding or tidal waves?			X
4. Plant Life. Will the proposal result in:			
a. Change in the diversity of species, or number of any species of plants (including trees, shrubs, grass, crops, and aquatic plants)?		X	
b. Reduction of the numbers of any unique, rare or endangered species of plants?			X
c. Introduction of new species of plants into an area, or in a barrier to the normal replenishment of existing species?			X
d. Reduction in acreage of any agricultural crop?		X	
5. Animal Life. Will the proposal result in:			
a. Change in the diversity of species, or numbers of any species of animals (birds, land animals including reptiles, fish and shellfish, benthic organisms or insects)?		X	
b. Reduction of the numbers of any unique, rare or endangered species of animals?			X
c. Introduction of new species of animals into an area, or result in a barrier to the migration or movement of animals?			X
d. Deterioration to existing fish or wildlife habitat?		X	
6. Noise. Will the proposal result in:			
a. Increases in existing noise levels?	X		
b. Exposure of people to severe noise levels?		X	
7. Light and Glare. Will the proposal produce new light or glare?			X
8. Land Use. Will the proposal result in a substantial alteration of the present or planned land use of an area?		X	
9. Natural Resources. Will the proposal result in:			
a. Increase in the rate of use of any natural resources?			X
b. Substantial depletion of any nonrenewable natural resource?			X
10. Risk of Upset. Will the proposal involve:			
a. A risk of an explosion or the release of hazardous substances (including, but not limited to, oil, pesticides, chemicals or radiation) in the event of an accident or upset conditions?			X
b. Possible interference with an emergency response plan or an emergency evacuation plan?			X
11. Population. Will the proposal alter the location, distribution, density, or growth rate of the human population of an area?	X		
12. Housing. Will the proposal affect existing housing, or create a demand for additional housing?	X		
13. Transportation/Circulation. Will the proposal result in:			
a. Generation of substantial additional vehicular movement?	X		
b. Effects on existing parking facilities, or demand for new parking?	X		
c. Substantial impact upon existing transportation systems?	X		
d. Alterations to present patterns of circulation or movement of people and/or goods?	X		
e. Alterations to waterborne, rail or air traffic?	X		
f. Increase in traffic hazards to motor vehicles, bicyclists or pedestrians?	X		
14. Public Services. Will the proposal have an effect upon, or result in a need for new or altered governmental services in any of the following areas:			
a. Fire protection?	X		
b. Police protection?	X		
c. Schools?	X		
d. Parks or other recreational facilities?	X		
e. Maintenance of public facilities, including roads?	X		
f. Other governmental services?	X		
15. Energy. Will the proposal result in:			
a. Use of substantial amounts of fuel or energy?	X		
b. Substantial increase in demand upon existing sources of energy, or require the development of new sources of energy?	X		
16. Utilities. Will the proposal result in a need for new systems, or substantial alterations to the following utilities:			
a. Power or natural gas?	X		
b. Communications systems?	X		
c. Water?	X		
d. Sewer or septic tanks?	X		
e. Storm water drainage?	X		
f. Solid waste and disposal?	X		
17. Human Health. Will the proposal result in:			
a. Creation of any health hazard or potential health hazard (excluding mental health)?		X	
b. Exposure of people to potential health hazards?		X	
18. Aesthetics. Will the proposal result in the obstruction of any scenic vista or view open to the public, or will the proposal result in the creation of an aesthetically offensive site open to public view?			X
19. Recreation. Will the proposal result in an impact upon the quality or quantity of existing recreational opportunities?			X
20. Cultural Resources.			
a. Will the proposal result in the alteration of or the destruction of a prehistoric or historic archeological site?		X	
b. Will the proposal result in adverse physical or aesthetic effects to a prehistoric or historic building, structure, or object?		X	
c. Does the proposal have the potential to cause a physical change which would affect unique ethnic cultural values?			X
d. Will the proposal restrict existing religious or sacred uses within the potential impact area?			X
21. Mandatory Findings of Significance.			
a. Does the project have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal or eliminate important examples of the major periods of California history or prehistory?		X	
b. Does the project have the potential to achieve short-term, to the disadvantage of long-term, environmental goals? (A short-term impact on the environment is one which occurs in a relatively brief, definitive period of time while long-term impacts will endure well into the future.)		X	
c. Does the project have impacts which are individually limited, but cumulatively considerable? (A project may impact on two or more separate resources where the impact on each resource is relatively small, but where the effect of the total of those impacts on the environment is significant.)			X
d. Does the project have environmental effects which will cause substantial adverse effects on human beings, either directly or indirectly?			X

Table 3-20(F)
CONJUNCTIVE USE OF SURFACE AND GROUND WATER
SUMMARY OF ENVIRONMENTAL IMPACTS

	YES	MAYBE	NO
1 Earth. Will the proposal result in:			
a. Unstable earth conditions or in changes in geologic substructures?			X
b. Disruptions, displacements, compaction or overcovering of the soil?	X		
c. Change in topography or ground surface relief features?		X	
d. The destruction, covering or modification of any unique geologic or physical features?			X
e. Any increase in wind or water erosion of soils, either on or off the site?		X	
f. Changes in deposition or erosion of beach sands, or changes in siltation, deposition or erosion which may modify the channel of a river or stream or the bed of the ocean or any bay, inlet or lake?			X
g. Exposure of people or property to geologic hazards such as earthquakes, landslides, mudslides, ground failure, or similar hazards?			X
2 Air. Will the proposal result in:			
a. Substantial air emissions or deterioration of ambient air quality?		X	
b. The creation of objectionable odors?			X
c. Alteration of air movement, moisture or temperature, or any change in climate, either locally or regionally?			X
3 Water. Will the proposal result in:			
a. Changes in currents, or the course or direction of water movements, in either marine or fresh waters?			X
b. Changes in absorption rates, drainage patterns or the rate and amount of surface water runoff?		X	
c. Alterations to the course or flow of flood waters?			X
d. Change in the amount of surface water in any water body?		X	
e. Discharge into surface waters, or in any alteration of surface water quality, including but not limited to temperature, dissolved oxygen or turbidity?			X
f. Alteration of the direction or rate of flow of ground waters?	X		
g. Change in the quantity of ground waters, either through direct additions or withdrawals, or through interception of an aquifer by cuts or excavations?	X		
h. Substantial reduction in the amount of water otherwise available for public water supplies?			X
i. Exposure of people or property to water related hazards such as flooding or tidal waves?			X
4 Plant Life. Will the proposal result in:			
a. Change in the diversity of species, or number of any species of plants (including trees, shrubs, grass, crops, and aquatic plants)?		X	
b. Reduction of the numbers of any unique, rare or endangered species of plants?			X
c. Introduction of new species of plants into an area, or in a barrier to the normal replenishment of existing species?			X
d. Reduction in acreage of any agricultural crop?		X	
5 Animal Life. Will the proposal result in:			
a. Change in the diversity of species, or numbers of any species of animals (birds, land animals including reptiles, fish and shellfish, benthic organisms or insects)?		X	
b. Reduction of the numbers of any unique, rare or endangered species of animals?			X
c. Introduction of new species of animals into an area, or result in a barrier to the migration or movement of animals?			X
d. Deterioration to existing fish or wildlife habitat?		X	
6 Noise. Will the proposal result in:			
a. Increases in existing noise levels?		X	
b. Exposure of people to severe noise levels?			X
7 Light and Glare. Will the proposal produce new light or glare?			X
8 Land Use. Will the proposal result in a substantial alteration of the present or planned land use of an area?		X	
9 Natural Resources. Will the proposal result in:			
a. Increase in the rate of use of any natural resources?			X
b. Substantial depletion of any nonrenewable natural resource?			X
10 Risk of Upset. Will the proposal involve:			
a. A risk of an explosion or the release of hazardous substances (including, but not limited to, oil, pesticides, chemicals or radiation) in the event of an accident or upset conditions?			X
b. Possible interference with an emergency response plan or an emergency evacuation plan?			X
11 Population. Will the proposal alter the location, distribution, density or growth rate of the human population of an area?	X		
12 Housing. Will the proposal affect existing housing, or create a demand for additional housing?	X		
13 Transportation/Circulation. Will the proposal result in:			
a. Generation of substantial additional vehicular movement?	X		
b. Effects on existing parking facilities, or demand for new parking?	X		
c. Substantial impact upon existing transportation systems?	X		
d. Alterations to present patterns of circulation or movement of people and/or goods?	X		
e. Alterations to waterborne, rail or air traffic?	X		
f. Increase in traffic hazards to motor vehicles, bicyclists or pedestrians?	X		
14 Public Services. Will the proposal have an effect upon, or result in a need for new or altered governmental services in any of the following areas:			
a. Fire protection?	X		
b. Police protection?	X		
c. Schools?	X		
d. Parks or other recreational facilities?	X		
e. Maintenance of public facilities, including roads?	X		
f. Other governmental services?	X		
15 Energy. Will the proposal result in:			
a. Use of substantial amounts of fuel or energy?	X		
b. Substantial increase in demand upon existing sources of energy, or require the development of new sources of energy?	X		
16 Utilities. Will the proposal result in a need for new systems, or substantial alterations to the following utilities:			
a. Power or natural gas?	X		
b. Communications systems?	X		
c. Water?	X		
d. Sewer or septic tanks?	X		
e. Storm water drainage?	X		
f. Solid waste and disposal?	X		
17 Human Health. Will the proposal result in:			
a. Creation of any health hazard or potential health hazard (excluding mental health)?			X
b. Exposure of people to potential health hazards?			X
18 Aesthetics. Will the proposal result in the obstruction of any scenic vista or view open to the public, or will the proposal result in the creation of an aesthetically offensive site open to public view?			X
19 Recreation. Will the proposal result in an impact upon the quality or quantity of existing recreational opportunities?		X	
20 Cultural Resources.			
a. Will the proposal result in the alteration of or the destruction of a prehistoric or historic archeological site?		X	
b. Will the proposal result in adverse physical or aesthetic effects to a prehistoric or historic building, structure, or object?		X	
c. Does the proposal have the potential to cause a physical change which would affect unique ethnic cultural values?			X
d. Will the proposal restrict existing religious or sacred uses within the potential impact area?			X
21. Mandatory Findings of Significance.			
a. Does the project have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal or eliminate important examples of the major periods of California history or prehistory?		X	
b. Does the project have the potential to achieve short-term, to the disadvantage of long-term, environmental goals? (A short-term impact on the environment is one which occurs in a relatively brief, definitive period of time while long-term impacts will endure well into the future.)		X	
c. Does the project have impacts which are individually limited, but cumulatively considerable? (A project may impact on two or more separate resources where the impact on each resource is relatively small, but where the effect of the total of those impacts on the environment is significant.)			X
d. Does the project have environmental effects which will cause substantial adverse effects on human beings, either directly or indirectly?			X

SECTION 2. RESPONSES TO WRITTEN COMMENTS ON THE DRAFT ES/EIR RECEIVED DURING PUBLIC REVIEW

The following section addresses written comments received during the public review period for the Draft ES/EIR. For review efficiency, comment letters have been divided into four categories:

- Federal Agencies
- State Agencies
- Local Agencies
- Private Entities, Environmental Organizations, and General Public

Responses are keyed to specific comments as indicated by numbers in the left-hand column of the comment letters. In some instances, no response was necessary; in these cases the response indicates that the comment was noted. All comments requiring corrections are referenced to Section 3.

COMMENTS AND RESPONSES

FEDERAL AGENCIES

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
215 Fremont Street
San Francisco Ca 94105

Project #D-COE-K28008-CA

Colonel Paul Bazilwich, Jr., District Engineer
Corps of Engineers, San Francisco District
211 Main Street
San Francisco, CA 94105

The Environmental Protection Agency (EPA) has received and reviewed the Draft Environmental Statement/Environmental Impact Report (ES/EIR) titled NORTH BAY AQUEDUCT (PHASE II FACILITIES), SOLANO COUNTY, CALIFORNIA.

The EPA's comments on the Draft ES/EIR have been classified as Category ER-2. Definitions of the categories are provided by the enclosure. The classification and the date of the EPA's comments will be published in the Federal Register in accordance with our responsibility to inform the public of our views on proposed Federal Actions under Section 309 of the Clean Air Act. Our procedure is to categorize our comments on both the environmental consequences of the proposed action and the adequacy of the environmental statement.

The EPA appreciates the opportunity to comment on this Draft ES/EIR and requests five copies of the Final ES/EIR when available.

If you have any questions regarding our comments, please contact Susan Sakaki, EIS Review Coordinator, at (415) 556-7858.

Sincerely yours,

Sheila M. Prindiville

Sheila M. Prindiville
Acting Regional Administrator

Enclosure

General Comments

1 Although the diversion of [illegible] water [illegible] may have only a minor effect on net Delta outflow, the cumulative effects of this and other existing and anticipated diversions may have significant impacts on the Delta. The Final ES/EIR should examine in greater depth the [illegible] impact of existing and proposed diversion [illegible] on water quality and salinity intrusion in the Delta. A quantitative comparison of the North Bay Aqueduct with other Delta [illegible] and existing Sacramento River flows should be included in the Final ES/EIR. (See water quality comment #. [illegible]

404 Permit Comments

2 Federal guidelines 40 CFR 230.10 state that [illegible] dredged or fill material shall be permitted if there is a practicable and environmentally preferable alternative which does not involve a discharge of dredged or fill material into the waters of the United States. [illegible] with the proposed action would not comply with the 404 [illegible] guidelines if it can be determined that [illegible] water supply alternatives evaluated in [illegible] the Draft ES/EIR is practicable and fulfills the [illegible] purpose of the proposed project.

3 The evaluation of alignment alternatives [illegible] part on the factual determinations required under 40 [CFR] 230.11. However, the Environmental Protection Agency [illegible] not agree to issuance of a Section 404 permit [illegible] clearly demonstrated that the construction of [illegible] facilities would not have an unacceptable adverse [illegible] either individually or in combination with [illegible] probable impacts of other activities affecting the Delta ecosystem.

Water Quality Comments

4 1. The mixed water supply concept [illegible] ferred Alternative by DWR. This would [illegible] water conservation and waste water reclamation as [illegible] water supply sources. However, page [illegible] of the Draft ES/EIR indicates that water conservation potential [illegible] the commercial and industrial sector is not [illegible] the plan since inadequate information is available to quantify this potential source of additional water. The Compendium on Industrial Water Allocation and Conservation in California, compiled in 1978 by the Governor's Office of Emergency Services, is one of various [illegible] which provide data on the significant water conservation potential in this sector. The Final ES/EIR should include an estimate of the conservation potential for the commercial and industrial sector as well as the estimate [illegible] for the residential sector.

5 2. In the discussion of the water quality impacts of the proposed project on the Delta, the ES/EIR states on page 138 that DWR has negotiated agreements with water agencies to guarantee water quality during State Water Project (SWP) operation under most conditions. This issue should be addressed more fully, indicating how additional releases to the Sacramento River (as described on page 136) can be guaranteed without jeopardizing SWP water obligations. Methods for protecting Delta water quality should be discussed in the event that additional releases cannot be guaranteed.

6 3. The Draft ES/EIR discusses on pages 134-135 and page 142 other mitigation measures which will be considered during construction and operation. The DWR and the Corps should commit to the following mitigation measures addressed in the Draft ES/EIR:

   a. Employ special erosion control measures to reduce sedimentation during construction (p. 134);

   b. Revegetate construction-disturbed areas (p. 134);

   c. Determine the temporary and permanent impacts of dewatering and protect any existing structures from subsidence (p. 134);

   d. Monitor groundwater quality in vernal pool areas if Alternative 2/2A is chosen (p. 134);

   e. Conduct comprehensive water quality studies to determine the suitability of using Cache Slough or Lindsey Slough for drinking water supplies (p. 142).

In addition, mitigation measures for disturbances to subsurface irrigation and drainage systems should be developed if Route 1 is chosen.

Air Quality Comments

7 1. The first sentence of Section 5.4.[illegible], page [illegible] should be revised to state that the Sacramento Valley Air Basin portion of Solano County is a nonattainment area only for ozone. (Note: the use of "oxidants" has been superseded by the term "ozone".)

8 2. The lead planning agency for the Sacramento Air Quality Maintenance Area is the Sacramento Area Council of Governments (SACOG).

9 3. Population projections included in the Association of Bay Area Governments' (ABAG's) "Projections 1979", which are used for the 1982 Nonattainment Area Plan update, indicate a Solano County population of 246,030 (198[illegible]) and 28[illegible] (1990). The Final ES/EIR should include these figures.

10 4. The amount of growth that could be accommodated by this project appears to be greater than the growth projected by the 1982 Nonattainment Area Plan update. Thus the proposed project may be inconsistent with the air quality plans being developed. The Final ES/EIR must state that both ABAG and SACOG have certified that the project and its induced growth are consistent with the latest Nonattainment Area Plans. It should also indicate if the Counties' General Plans, with respect to population, employment, and housing reflect the growth induced by the proposed project.

5. Section 5.4.3 contains several statements which should be revised to provide the public with a better understanding of the present status and direction of air quality planning in Solano County. The suggested revisions are as follows:

   a. The last sentence of Section 5.4.3.[illegible], page [illegible], should be revised to read:

11 "With respect to hydrocarbon emissions from mobile sources, the 1979 Bay Area Air Quality Plan [illegible] locally commits to a motor vehicle inspection and maintenance program [illegible] for such a program has not been [illegible] State Legislature; [illegible] mentation of the California [illegible] Program (emission standards [illegible] California and [illegible] commit [illegible] of five classes of transportation [illegible] to reduce the amount of vehicle [illegible]

PRECEDING PAGE BLANK-NOT FILMED

-4-

b. The second sentence of Section 5.4.3.1, page 71, should be revised to read:

12 "Carbon monoxide control strategies in the Bay Area Basin include reducing CO levels in motor vehicle exhaust through the continued implementation of the California Motor Vehicle Control Program, motor vehicle inspection and maintenance, and transportation control measures to reduce vehicle miles traveled."

c. The last sentence of Section 5.4.3.2, page 71, should be revised to read:

13 "The 1979 Plan for the Sacramento Air Quality Maintenance Area contains transportation control measures for the study area, including ridesharing, pedestrian controls and amenities, bicycle incentives, and park-and-ride lots. It also commits to a motor vehicle inspection and maintenance program (although the legal authority for such a program has not been provided by the State Legislature)."

EIS CATEGORY CODES

Environmental Impact of the Action

LO—Lack of Objections

EPA has no objection to the proposed action as described in the draft impact statement or suggests only minor changes in the proposed action.

ER—Environmental Reservations

EPA has reservations concerning the environmental effects of certain aspects of the proposed action. EPA believes that further study of suggested alternatives or modifications is required and has asked the originating Federal agency to reassess these aspects.

EU—Environmentally Unsatisfactory

EPA believes that the proposed action is unsatisfactory because of its potentially harmful effect on the environment. Furthermore, the Agency believes that the potential safeguards which might be utilized may not adequately protect the environment from hazards arising from this action. The Agency recommends that alternatives to the action be analyzed further (including the possibility of no action at all).

Adequacy of the Impact Statement

Category 1—Adequate

The draft impact statement adequately sets forth the environmental impact of the proposed project or action as well as alternatives reasonably available to the project or action.

Category 2—Insufficient Information

EPA believes that the draft impact statement does not contain sufficient information to assess fully the environmental impact of the proposed project or action. However, from the information submitted, the Agency is able to make a preliminary determination of the impact on the environment. EPA has requested that the originator provide the information that was not included in the draft statement.

Category 3—Inadequate

EPA believes that the draft impact statement does not adequately assess the environmental impact of the proposed project or action, or that the statement inadequately analyzes reasonably available alternatives. The Agency has requested more information and analysis concerning the potential environmental hazards and has asked that substantial revision be made to the impact statement.

If a draft impact statement is assigned a Category 3, no rating will be made of the project or action, since a basis does not generally exist on which to make such a determination.

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE
630 Sansome Street
San Francisco, California 94111

1950
July 7, 1981

Colonel Paul Bazilwich, Jr
District Engineer
Department of the Army, Corps of Engineers
211 Main Street
San Francisco, CA 94105

Dear Colonel Bazilwich

Thank you for the opportunity to review the North Bay Aqueduct Phase II Facilities Draft Environmental Impact Statement. National Forest System lands and resources are not involved, and we therefore have no comment. Additionally, it will not be necessary to send us further environmental documents for this project.

Sincerely,

Jon D. Kennedy

JON D. KENNEDY, Director
Land Management Planning

GENERAL COUNSEL OF THE
UNITED STATES DEPARTMENT OF COMMERCE
Washington, D.C. 20230

Mr. Harvey Upton
Environmental Resources Planner
U.S. Army Engineer District
211 Main Street
San Francisco, California 94105

Dear Mr. Upton:

This is in reference to the draft environmental impact statement entitled, "North Bay Aqueduct Phase II Facilities, Solano County, California." The enclosed comments from the National Oceanic and Atmospheric Administration are forwarded for your consideration.

Thank you for giving us an opportunity to provide these comments, which we hope will be of assistance to you. We would appreciate receiving four copies of the final environmental impact statement.

Sincerely,

R. T. Miki

Robert T. Miki
Director of Regulatory Policy

Enclosure Memo from: Alan W. Ford
National Marine Fisheries Service
National Oceanic and Atmospheric Administration

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Region
300 South Ferry Street
[illegible]

[illegible]

[illegible] Marine Fisheries Service has reviewed the Draft [illegible] Draft Environmental Impact Report [illegible] North Bay [illegible] Phase II Facilities, [illegible] County, California [illegible]

In order to provide as timely a response to your request for comments [illegible], we are submitting the enclosed comments to you directly, in [illegible] with the [illegible] transmittal to the Department of Commerce [illegible] Departmental response. These comments represent the views of the National Marine Fisheries Service. The formal, consolidated views of the Department should reach you shortly.

Sincerely yours,

Alan W. Ford
Regional Director

Enclosure

[illegible] MacKostie
Chief, Central District, DWR
Sacramento, CA

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration

[illegible]

[illegible] have reviewed the Draft [illegible] alternate alignments [illegible] unable to evaluate the impacts [illegible] resources.

1 The [illegible] provides [illegible] alternate intake sites [illegible] are available for [illegible] justification, therefore, [illegible] Cache Slough and Calhoun Cut are [illegible] resources than Lindsey Slough.

2 The limited unpublished information [illegible] that all of the intake sites are probably [illegible] for estuarine and anadromous fishes. [illegible] Fisheries Service (NMFS) has learned that [illegible] private consultants showed this site [illegible] striped bass and probably salmon [illegible] increases in flow velocities [illegible] operation of the North Bay Aqueduct [illegible] hence the fishery value of this site.

3 Although fish screens are [illegible] which site is selected for the intake, [illegible] fish eggs and larvae (DEIR page [illegible]). It is important, therefore, [illegible] resources be thoroughly evaluated at each site [illegible] selected and the impacts of the construction and operation [illegible] resources adequately delineated. The DEIR suggests that studies [illegible] "conducted in the slough finally selected as the diversion point [illegible] specific baseline information on fish spawning areas and nursery [illegible] their sensitivity to the diversions" [illegible] considered as a possible mitigation [illegible]

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4 The NMFS believes it is inappropriate to consider such baseline studies [illegible] mitigation and further inappropriate that they be conducted only after an intake site is selected. Such studies should form the basis for selecting the preferred alternative and should be conducted and evaluated for all sites being considered prior to that selection. Failure to complete such an evaluation would violate, in our opinion, the requirements of the National Environmental Policy Act (NEPA) which states that "if the information relevant to adverse impacts is essential to a reasoned choice among alternatives and is [illegible] and the overall costs of obtaining it are not exorbitant, the agency shall include the information in the environmental impact statement" (40 CFR [illegible]). The evaluation should include not only possible intake sites on Lindsey Slough, Cache Slough, Calhoun Cut, and (as suggested in the DEIR on page [illegible]) the Sacramento Deep-Water Ship Channel, but mitigation plans to rectify any fishery losses that cannot be avoided as well (see NEPA 40 CFR 1508.20). These mitigation plans might include operational standards to provide protection for fish eggs and larvae by requiring reduced or ceased pumping during periods of high vulnerability of these life stages. Without adequate evaluation of fishery resources at the intake sites and mitigation plans to minimize fishery impacts, the NMFS would be unable to complete its evaluation of the DEIR. Under these circumstances we would have to consider recommending that the Administrator of NOAA request that the Secretary of Commerce seek to refer this matter to the Council on Environmental Quality under the criteria for referral in the NEPA Regulations (40 CFR 1504.2).

Cumulative Impacts

5 Although the DEIR discusses cumulative impacts and mitigation measures better than many of the environmental statements we have reviewed, it fails, in our opinion, to meet the requirements for these discussions as called for under NEPA (40 CFR 1508.7), and the Corps regulations (33 CFR 320.4). The combined impacts of the NBA, the Peripheral Canal, the Sacramento Deep-Water Ship Channel, the Suisun Marsh Protection Facilities, the San Joaquin Valley Salt Drain, and proposed PG&E plant at Collinsville are inadequately discussed, although all of these projects are mentioned. Their proposed impacts are discussed strictly as they relate to water quality (salinity) and not [illegible] resources. Of particular concern is the combined impact of these [illegible] on the quantity of fresh-water outflow to the San Francisco Bay-Delta estuary.

6 [illegible] though the capacity of the NBA appears to be small (115 cfs), this flow represents [illegible] percent of the projected flow of the Sacramento River when the proposed Peripheral Canal is operational (Water Right 1485 standards) and therefore could be significant. We recommend that the cumulative impacts of the aforementioned projects on fishery resources be fully evaluated in the Final Environmental Statement to comply with NEPA (40 CFR 1508.7).

7 The NMFS is concerned further that the cumulative effects of water diversions have already had a significant adverse impact on fishery resources utilizing the estuary. Further reductions in outflow will be detrimental even though the impact of the NBA may not appear significant when viewed by itself. We therefore strongly support the intent of the "preferred alternative" to minimize diversions by the NBA through maximum use of water conservation and

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wastewater reclamation (DEIR page [illegible])
8 policies should be examined in the [illegible]
water. In the Final Environmental Statement we [illegible]
water conservation be more fully discussed [illegible]

CLEARANCE: SIGNATURE AND DATE

F/HP: R. Smith ____________

UNITED STATES
DEPARTMENT OF THE INTERIOR

OFFICE OF THE SECRETARY

PACIFIC SOUTHWEST REGION
BOX 36098 • 450 GOLDEN GATE AVENUE
SAN FRANCISCO CALIFORNIA 94102
(415) 556 8200

ER [illegible] 14 [illegible] July 12, 1981

Commander Paul Bazilwich, Jr.
San Francisco District
Corps of Engineers
211 Main Street
San Francisco, California 94105

Dear Commander Bazilwich:

The Department of the Interior has reviewed the draft environmental statement/environmental impact report for North Bay Aqueduct (Phase II Facilities), Solano County, California. The following comments are provided for your use and consideration.

Fish and Wildlife Resources

1 In response to your public notice on this project, the Fish and Wildlife Service (FWS) on January 15, 1980, provided a reply in which several items of concern were listed. These were items, related to the FWS's area of expertise, which they believed needed to be addressed in the ES/EIR. The subject document has addressed most of these concerns and, as a result, the draft statement adequately describes the resources and impacts associated with the terrestrial aspects of the project. The document is deficient, however, in presenting information on aquatic resources at the three alternative diversion sites. Yet, despite this lack of information, statements are presented as to the relative value of these sites and are used to determine relative impacts. We question the validity of this procedure and believe that the present analysis of project impact on aquatic resources is questionable. Considering the complexity of the aquatic resources of the Delta, and the controversy surrounding their protection, additional information on project impact needs to be developed and presented in the final statement.

Cultural and Recreational Resources

2 There is no indication that the California State Historic Preservation Officer (SHPO) has been consulted regarding the significance of sites located within the proposed alternate Routes 1, 4, and 6. Determinations of eligibility for the National Register of Historic Places should be made in consultation with the SHPO in accordance with the requirements of 36 CFR 800.4. Such consultation should be documented in the Final ES/EIR.

3 Discussions of the ineligibility of Site CA-Sol-[illegible] and the historic archeological site referenced on page E-2[illegible], for the National Register are premature. It is recommended that if the alternative routes which impact these sites are chosen in the final plan, a program of archeological testing be conducted on each site to determine the extent to which these sites actually contain significant data eligible for the Register. Additional historical documentation should also be conducted to determine the age, function, and history of the historic site, without such research, archeological excavations would be useless. Data recovery in consultation with the California SHPO and the Advisory Council on Historic Preservation should be initiated if the testing program suggests that resources present have significant values. Guidelines for this process are set forth at 36 CFR 800.

Specific Comments

4 References to the Water and Power Resources Service, in the text, should be changed to the Bureau of Reclamation.

5 Page 1, Para. 1.2, 1.2.1. What is the source of the developed water supply? This should be disucssed as it might affect Central Valley Project (CVP) operations.

6 Page 14, Table 3-1. What is the source of the waste water figure of 1[illegible],000-60,000 ac.-ft./yr? In the Bureau of Reclamation's (BR) Solano County Water Project Report of October 1980, the most recent figure is 32,800 ac.-ft./yr.

7 Pages 15-16, Para. 3.2.1.1.3. The interim supply of 7,500 ac.-ft./yr. from Lake Berryessa should not be considered a permanent existing supply. Consequently, it is misleading to say that Napa will only need 17,500 acre-feet.

8 Page 18, Para. 3.2.2.3. A BR requirement to allow use of greater than safe yield of project water would be an agreement on deficiency criteria when critical period requires imposing deficiencies. Solano County Flood Control and Water Conservation District have not agreed to this concept.

9 Page 19, Para. 3.2.2.4.3. What would be the quality of the water that might be disposed of via a pipeline to the Carquinez Strait? Potential impacts need to be analyzed.

10 Page 19, Para. 3.2.2.5. The West Sacramento Valley Canal Unit alternative is highly unlikely in the near future because of lack of support. The BR has recently completed a concluding report on the project.

11 Page 33, Para. 3.2.2.3.5 (2nd para.). The technology is ready and available to remove metals and salt from waste water, if required. Also, the City of Fairfield currently has a contract with Solano Irrigation District to utilize the city's effluent for agricultural uses.

12 Page 66, Para. 5.3.1.3.1. Regarding endangered species, mention should be made of the consultation process with the FWS and the results of the process.

2

13 Page [illegible], Figure 5-4. Someone unfamiliar with the Suisun Marsh Management Areas could not readily identify where the Primary Management Area is on the map provided. A more distinct designation is needed for identification.

14 Page 69, Para. 5.3.2.2.4. The last sentence in this paragraph is misleading as no information exists relative to aquatic resources at Cache Slough. In addition, while overall fish abundance and diversity may be lower, species of greater importance may be present.

15 Page 7[illegible], Para. 5.3.2.3.3. This information concerning the location of the salt marsh harvest mouse is not necessarily correct. For more complete information, they should refer to a recently completed BR biological assessment.

16 Page 7[illegible], Para. 5.5.2.1. Impact corridor surveys have only been conducted on Routes 1, 4, and 6. Although Routes 1 and 4 are the preferred alternatives, if other routes presently unsurveyed are chosen, then a complete intensive survey should be conducted as soon as possible to allow proper consideration of cultural resources during the planning process.

17 Page 76, Para. 5.8.3. The report should mention the Suisun Marsh State Wildlife Management Areas as part of the recreational facilities inventory.

18 Page 77, Para. 5.8.5.2. It is the BR's contention that the mentioned reclaimed waste water will not flush Cordelia Slough; it will only serve as a partial hydraulic barrier against salinity intrusion for Grizzly Bay.

19 Page 13[illegible]. Impacts of Cordelia Forebay should be addressed here. One impact needing discussion would be rafting of waterfowl.

20 Page 133, Para. 6.1.1.4.1. The provision of screens at the diversion structures should be mentioned as a planned mitigation measure.

21 Page 133, Para. 6.1.1.5. The report recommends that in the event that cultural resources are discovered during construction then an archeologist will be contacted to evaluate the finds and determine methods to ameliorate expected impacts. This is inappropriate given that unevaluated sites are already known within the impact corridors proposed. It is suggested that known resources be completely assessed as mentioned earlier, and this approach be reflected under Possible Mitigation Measures.

22 The discussion is inappropriate, especially when the reader is presented with twenty possible mitigation measures that may not even be used in the project. Mitigation measures should involve commitment.

23 Page 135, Para. 6.1.1.5. For open canal alternatives, the provision of a roughened canal surface to allow small mammals and reptiles to escape should be included. Also, it is unlikely that the FWS would recommend the placement of escape ramps in the canal unless a problem with large animals, such as deer, was evident.

24 Page 138, Para. 6.1.[illegible].4. Effects to fish migrating from the Sacramento River and impacted by the pumps in the Delta should be considered. Also, the potential loss of zooplankton as a result of the project should be addressed.

25 Pages 136-139, Para. 6.1.2.4.6. The last statement should be reworded. At present, it implies that a concrete-lined canal would provide favorable wildlife habitat. Except for birds, concrete canals are frequently a death trap.

26 Page 142, Para. 6.1.2.10. It seems inappropriate to study aquatic resources after one of three alternatives is selected. Also, how can the collection of baseline information after the selection of a project alternative be considered a mitigation measure?

Thank you for the opportunity to comment on this ES/EIR.

Sincerely,

Patricia Port

Patricia Sanderson Port
Regional Environmental Officer

cc: Director, OEPR (w/incoming copy)
Director, Fish and Wildlife Service
Director, National Park Service
Director, Geological Survey
Director, Bureau of Mines
Director, Bureau of Reclamation
Reg. Dr., FWS
Reg. Dr., NPS
Reg. Dr., GS
Reg. Dr., BM
Reg. Dr., BR

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
REGION NINE
Two Embarcadero Center, Suite 530
San Francisco, California 94111

August 12, 1981

IN REPLY REFER TO
HFP-09

Colonel Paul Bazilwich, Jr.
San Francisco District Engineer
U.S. Army Corps of Engineers
211 Main Street
San Francisco, California 94105

Dear Colonel Bazilwich:

We have reviewed the draft environmental impact statement for the North Bay Aqueduct (Phase II Facilities) in Solano County, California, and provide the following comment.

1. The safety, design, and operational integrity of the Interstate and State highways and other transportation facilities in the project area should not be diminished by the construction of the proposed project. Continual contact with the California Department of Transportation (Caltrans) should be maintained during project development and construction to coordinate the subject project with the Interstate, State, and local highway systems.

2. Any encroachment of an Interstate route right-of-way by the subject project must be approved by the Federal Highway Administration.

3. Traffic control plans, including detours, to accommodate highway traffic through the project construction area(s) need to be prepared for all affected highway routes and summarized in the environmental impact statement.

4. In addition, construction haul routes and any related impacts (noise, dust, safety, traffic delays) need to be identified and addressed in the EIS.

We appreciate this opportunity to review the subject draft EIS and would like to receive a copy of the final statement when it becomes available.

Willis Kisselburg, Jr.
Willis Kisselburg, Jr.
Acting Director, Office of
Environmental Programs

FEDERAL ENERGY REGULATORY COMMISSION
333 MARKET STREET 6th FLOOR
SAN FRANCISCO CA 94105

Colonel Paul Bazilwich, Jr.
District Engineer
San Francisco District
U.S. Army Corps of Engineers
211 Main Street
San Francisco, CA 94105

Dear Colonel Bazilwich:

This is in response to your letter of July 2, 1981, requesting comments on your Draft Environmental Statement/Environmental Impact Report, North Bay Aqueduct (Phase II Facilities), Solano County, California, dated June 1981.

Our review of other agencies' environmental impact statements concentrates basically on those areas of the electric power and natural gas industries for which the Federal Energy Regulatory Commission has jurisdiction by law, or where the staff has special expertise in evaluating environmental impacts involved with the proposed action. It appears that there would not be any significant impacts in these areas of concern nor serious conflicts with this agency's responsibilities should this action be undertaken.

Thank you for the opportunity to review this statement.

Sincerely,

Eugene Neblett
Regional Engineer

FEDERAL ENERGY REGULATORY COMMISSION
WASHINGTON 20426

IN REPLY REFER TO

July 21, 1981

Mr. Paul Bazilwich, Jr.
Colonel, CE
U. S. Department of the Army
211 Main Street
San Francisco, CA 94105

Dear Colonel Bazilwich:

I am replying to your request of July 2, 1981 to the Federal Energy Regulatory Commission for comments on the Draft Environmental Impact Statement for the North Bay Aqueduct (Phase II Failities). This Draft EIS has been reviewed by appropriate FERC staff components upon whose evaluation this response is based.

This staff concentrates its review of other agencies' environmental impact statements basically on those areas of the electric power, natural gas, and oil pipeline industries for which the Commission has jurisdiction by law, or where staff has special expertise in evaluating environmental impacts involed with the proposed action. It does not appear that there would be any significant impacts in these areas of concern nor serious conflicts with this agency's responsibilities should this action be undertaken.

Thank you for the opportunity to review this statement.

Sincerely,

Jack M. Heinemann
Advisor on Environmental Quality

DEPARTMENT OF TRANSPORTATION
UNITED STATES COAST GUARD

Commander (d.)
Twelfth Coast Guard Dist
630 Sansome Street
San Francisco, CA 94126
Phone (415) 556-6274

16604

From: Commander, Twelfth Coast Guard District
To: San Francisco District Engineer, U. S. Army Corps of Engineers

Subj: Corps of Engineers Public Notice #12950-58; review of

1. The Twelfth Coast Guard District has reviewed the subject notice. Our comments are as follows:

a. Intake and outfall pipelines should be marked in accordance with the State Waterway Marking System and applications filed with State of California Department of Boating and Waterways.

b. Para 6.1.1.1.5: The crossing of the tidal portion of any waterway by overhead pipes or bridges will require the prior approval of the Coast Guard. A Bridge Permit Application Guide is enclosed.

2. Thank you for the opportunity to review.

By direction

Encl: As stated

SPEED LIMIT 55

Advisory
Council On
Historic
Preservation

of Executive Order 11593

1522 K Street, NW
Washington DC 20005

Reply to

Lake Plaza South, Suite 616
44 Union Boulevard
Lakewood CO 80228

August 12, 1981

Colonel Paul Bazilwich, Jr.
District Engineer
Department of the Army
San Francisco District, Corps of Engineers
211 Main Street
San Francisco, California 94105

Dear Colonel Bazilwich:

This is in response to your request of July 2, 1981, for comments on the draft environmental impact statement (DES) for the North Bay Aqueduct, Solano County, California.

The Council has reviewed the DES and notes that the Corps has determined
that the proposed undertaking will not affect properties included in
or eligible for inclusion in the National Register of Historic Places.
We also note that archaeological surveys have located a number of sites,
and the area is known to be rich in cultural properties. It is possible
that some of these sites are eligible for inclusion in the National Register.
The Corps should consult with the California State Historic Preservation
1 Officer and, if necessary, the Keeper of the National Register, to determine
if the sites are eligible. If, after evaluation of the sites, it is
determined either that they are not eligible or that they will not be
affected by the undertaking, we suggest that the SHPO's concurrence be
included in the final environmental impact statement. If, however, they
are determined eligible, the Corps must afford the Council an opportunity
to comment before completing the final environmental statement and making
its decision on the undertaking.

Should you have questions, please call Jane King at (303) 234-4946, an FTS number, for assistance.

Sincerely,

Louis S. Wall
Chief, Western Division
of Project Review

Commenting Entity: U. S. Environmental Protection Agency
August 31, 1981

Response 1

Diversions from the North Bay Aqueduct, while small, contribute to cumulative effects of existing and planned projects. There are two general areas of existing cumulative effects. One is impacts of cumulative diversions on the Bay-Delta estuary system. The other is the impacts of cumulative water storage requirements to provide releases to provide protective flows for water quality, fish, and wildlife and to meet contractual commitments of water purveyors. Future water development will require construction of additional storage facilities to provide water for releases to supplement summer and dry year flow conditions. This response describes the affected environment, the impacts of existing projects on the environment, and the additional impacts caused by the North Bay Aqueduct and other planned projects. Finally, this response will discuss mitigation measures that both the Department and other project proponents could or are intending to take with regard to cumulative impacts.

Cumulative Impacts on the Bay-Delta Estuary

The complex environment of the Bay-Delta estuary system has been impacted by many factors: (1) land reclamation; (2) waste water effluent and surface runoff from local and upstream urban development; (3) oil spills; (4) drainage and leaching water discharge from Delta and upstream agricultural water use; (5) commercial fishing; (6) sports fishing; (7) construction of deep water channels; (8) use of natural inflows by agricultural and urban development, upstream storage of natural inflows by the Central Valley Project, State Water Project, Hetch Hetchy Aqueduct project, and Mokelumne Aqueduct project; and (9) Delta diversions by the Central Valley Project, State Water Project, local municipal and industrial water users, and Delta agricultural water users.

These are still the main factors that impact the present Bay-Delta estuary environment, except for commercial fishing in the Delta region. Commercial fishing still occurs in the Bay, mainly for bait. Salmon, which migrate through the estuary system from the ocean are presently subjected to commercial fishing in the ocean.

Natural features of the Bay-Delta estuary that affect the environment are ocean tides and salinities, fresh water inflows, and interior Delta flow patterns. Ocean salinity intrusion varies with inflow rates. Tide fluctuations occur in regular cycles throughout the year. Historically, the range of inflows varied greatly between winter and summer periods. In some years before water development occurred, salinity intrusion caused nearly all of the estuary channels to reach chloride concentrations in excess of 1,000 mg/L. This occurred in 1924, 1926, 1934, and 1939.

Water development has, in general, reduced the monthly variation in Delta inflows by decreasing winter inflows and increasing summer inflows. Water development has also caused reductions in total yearly Delta outflows. The unimpaired natural inflow to the Delta is an average of about 30 million

acre-feet (MAF) per year. This volume is currently being divided between upstream storage, upstream use, Delta use, Delta exports, and Delta outflow. Currently the average annual upstream use and project storage is about 8.8 MAF/year, Delta outflow and consumptive use needs are about 5.7 MAF/year, project exports are about 6.1 MAF/year, and Delta outflows in excess of minimum requirements total about 9.4 MAF/year.

The major areas of the Bay-Delta estuary include the Sacramento-San Joaquin Delta region, the Suisun Marsh, and the San Francisco Bay complex. Each of these areas support a rich environment of fish and wildlife.

The Delta region includes about 740,000 acres and constitutes the statutory Delta. Cultivated land in the Delta totals 550,000 acres.

Land reclamation of the former marshlands has removed much of the once lush expanses of native vegetation; however, the Delta remains a habitat for a multitude of fish and wildlife species. Salmon, shad, and steelhead migrate through the Delta. The estuary provides an important nursery area for striped bass. The Delta contributes 20 percent of the pheasants harvested in the State. Ten rare and endangered vertebrate species are known to occur in the Delta, none of which are exclusively confined to that area.

The Sacramento-San Joaquin Delta region is within the area bordered by the cities of Sacramento, Stockton, Tracy, and Pittsburg. The Delta islands are sparsely populated. Upland areas, particularly in the western Delta have undergone steady industrialization and urbanization. Recreation and second home developments have begun to encroach on the edges of the peat land.

The Delta, with its vast waterways and picturesque settings, constitutes one of the major recreation attractions in California. The major environmental problems for the Delta are:

° Wildlife Habitat: Disappearance of critical marsh and riparian lands.

° Land Subsidence: Causes seepage and levee failure.

° Export Diversions: Cause flow reversal problems and decreases in annual total outflow volumes, which increase ocean salinity intrusion and can adversely affect fish.

° Water Quality: High concentrations of mineral salts in the southern Delta. Dissolved oxygen problems in the San Joaquin River Deep Water Channel near Stockton and in dead-end sloughs. Waste discharge from subdivisions, houseboats, marinas, municipalities, and industries. Increased salinity from irrigation return flows.

° Fish: Diversions and localized poor water quality adversely affect striped bass, salmon, and resident fish, as well as their food organisms.

° Agriculture: Major problems with drainage, soil conditions, and poor water quality in some areas.

The Suisun Marsh region, about 40 miles east of the Golden Gate, is an important segment of the Pacific Flyway for waterfowl and constitutes 10 percent of

California's remaining natural wetland on the Pacific Flyway. The southern corner of the marsh is west of the confluence of the Sacramento and San Joaquin Rivers. Freshwater outflow from the Delta directly affects the salt balance of the marsh.

Most of the 55,000 acres of marshland and small waterways are enclosed within a levee system. About 45,000 acres (82 percent) are privately owned and used primarily for duck clubs. The remainder (18 percent), owned by the State, includes waterfowl management and refuge areas and public recreation areas.

The expanses of unbroken native habitat and the wide diversity of vegetation and aquatic conditions that prevail make the marsh a valuable wildlife habitat.

The primary use of the marsh is for duck hunting. The diverse resources of the marsh also provide opportunity for a broad spectrum of public recreation uses. The area supports up to 20 percent of California's wintering duck population and a variety of residential and anadromous fish. It also constitutes part of the range of several rare and endangered species.

The major environmental problem for the marsh is maintenance of proper vegetative composition to support existing wildlife. This requires a water supply of adequate salinity concentration to permit continuation of vegetative management practices.

The San Francisco Bay complex comprises portions of all of nine surrounding counties and includes San Francisco, San Pablo, Suisun, Grizzly, and Honker Bays. The entire estuarine complex covers almost 435 square miles and is rimmed by 275 miles of shoreline. The habitat afforded by the Bay and surrounding lands supports a multiplicity of fish and wildlife species. The Bay complex is among the most urbanized areas in California.

The largest surface water inflow to the Bay is provided by runoff from the Central Valley (Delta outflow). Flushing of pollutants from the upper bays is affected to varying degrees by operation of the Central Valley Project and State Water Project. In general, the projects provide greater summer inflow and somewhat less winter inflow than would otherwise occur.

With continued population and industrial growth, a primary concern is the effect of increased waste discharges on bay water quality, regardless of project operation.

The major environmental problems of the Bay complex are:

° Water Quality: Municipal and industrial waste discharges causing adverse effects on fish and invertebrates; reduced diversity of benthic organisms; and low dissolved oxygen in shallow areas of bay, reaches of Napa and Petaluma Rivers, and southernmost part of bay. Excessive algal concentration in localized areas of South Bay and Suisun Bay. Odor and floating materials. Numerous oil spills.

° Delta outflows in winter, which are of large volume and short duration, can cause fresh water to penetrate well into the Central Bay and be brought into the South Bay by tidal exchange. Such events cause salinity stratification

in much of the South Bay that can persist for several weeks or months following the initial appearance of fresh water. Reduction of these inflows may adversely affect the Bay environment.

Cumulative Impacts on Reservoir Storage Development

Diversion projects require reservoirs for storage both upstream and downstream of the Delta. The specific environments will vary, depending on where the reservoirs are located. They can be located in areas of significant biological, cultural, or historical value. General impacts associated with development of surface and ground water storage include:

° Disruption, displacement, compaction, and over-covering of soils.

° Change in topography or ground surface relief features.

° Potential destruction, covering, or modification of unique geologic or physical features.

° Changes in deposition or erosion of existing waterways.

° Exposure of people and property to dam failure hazards.

° Some additional air emissions due to construction activities and additional population growth around reservoir locations.

° Changes in the course or flow patterns of natural rivers.

° Changes in absorption rates, drainage patterns, and amount of surface water runoff.

° Alterations to the course or flow of floodwaters.

° Changes in the amount of surface water in various areas.

° Changes in surface water quality, temperature, dissolved oxygen, and turbidity.

° Alteration of ground water flow and quantities.

° Changes in the diversity of species of plants, potentially affecting unique or rare and endangered species.

° Reduction in acreage of any agricultural crop.

° Changes in habitats for animal life, potentially affecting unique, rare, or endangered species.

° Introduction of a barrier to the migration and movement of animals.

° Some noise level increases resulting from recreation and local population growth.

- Development and use of the natural resource of water.

- Local population and growth rate increase around new reservoirs. Also, changes in population distribution and densities. These changes in population can impact housing, transportation, public services, and utilities.

- Potential increased energy use from development of certain ground water programs and offstream storage reservoirs. Instream reservoirs can develop new hydroelectric energy supplies.

- Increases in various recreational uses.

- Potential alteration or destruction of cultural resources.

General Impacts of Existing Projects

In general, the North Bay Aqueduct could contribute to cumulative impacts by:

- Causing diversions, which could affect striped bass, salmon, and resident fish and their food organisms. The Department of Fish and Game estimates that current fish and wildlife levels in the Delta are about 60 percent of historical average levels and that they will continue to drop. (See Bulletin 76 and Department of Fish and Game report, "Restoration of Fish and Wildlife in Sacramento-San Joaquin Estuary", June 1978.)

- Reducing unregulated outflows, which could cause changes in the Bay-Delta environment.

- Increasing the need for upstream storage to provide releases necessary to maintain water quality in the Delta.

This discussion will focus on the related projects and impacts listed above. Such projects that are related to the North Bay Aqueduct include the Central Valley Project, the Hetch Hetchy Project, the Mokelumne River Project, and the State Water Project, all of which utilize natural inflow to the Delta. Descriptions of these projects are presented below.

Existing Federal Central Valley Project

The existing Federal Central Valley Project reservoir systems providing Delta export supplies and augmenting low summer and fall flows to the Delta are: the Shasta Division, the Trinity River Division, the Folsom Unit of the American River Division, and the New Melones Reservoir on the Stanislaus River.

Shasta Lake, on the Sacramento River above Redding, regulates floods and stores winter runoff for hydroelectric power generation, irrigation in the Sacramento Valley, recreation, and Delta exports. These supplies are supplemented by diversions from the Trinity River Division.

Clair Engle Lake and Whiskeytown Lake are the major reservoirs of the Trinity River Division. Folsom Lake regulates flows of the American River for flood

control, power, irrigation, municipal and industrial use, fish and wildlife, and recreation.

New Melones Reservoir was planned to be operated for flood control, local water needs, power, fishery enhancement, and water quality control for San Joaquin River inflows to the Delta. However, the State Water Resources Control Board has restri ted the level of filling New Melones Reservoir until contracts are executea r use of the additional water developed by the reservoir.

San Luis Reservoir and associated pumping and generating plants are joint-use facilities of the Central Valley Project and the State Water Project. Water diverted from the Delta at the Tracy and Harvey O. Banks Delta pumping plants is pumped southward to San Luis Reservoir primarily during winter and spring for release to service areas during summer and fall.

The major conveyance facility of the Central Valley Project is the Delta-Mendota Canal, which diverts water from the Delta at the Tracy Pumping Plant and transports it southward to San Luis Reservoir and various service areas. Over half of the water diverted by the Tracy Pumping Plant is delivered to the Mendota Pool for distribution to holders of downstream water rights who exchanged their rights to San Joaquin River flows for Central Valley Project water.

The flows of the San Joaquin River stored at Millerton Lake are distributed north and south by the Madera and Friant-Kern canals.

The Contra Costa Canal also diverts water from the Delta to serve industries and municipalities in parts of Contra Costa County.

The Delta Cross Channel, 30 miles south of Sacramento, helps provide for regulated passage of Sacramento River water through Delta channels to Delta-Mendota Canal and Contra Costa Canal pumping plants.

More than 60 agencies have contracts or commitments with the Central Valley Project for long-term water supplies from the Delta. The project currently exports 3.4 million acre-feet yearly and will ultimately export about 4.3 million acre-feet in a normal year if existing, authorized, and planned project facilities are operational.

Hetch Hetchy Project

The Hetch Hetchy Project delivers municipal and industrial water supplies to the City and County of San Francisco. This project stores water on the Tuolumne River and Cherry Creek, both tributaries that provide natural inflow to the Bay-Delta estuary. The project diverts the stored water supplies by an aqueduct around the estuary system, thereby reducing the natural inflow to the Delta. The two major reservoirs of this project are the Hetch Hetchy Reservoir on the Tuolumne River and the Cherry Lake Reservoir on Cherry Creek. These reservoirs have maximum storage capacities of 360,000 acre-feet and 268,000 acre-feet, respectively.

Mokelumne River Project

The Mokelumne River Project reduces the natural inflow to the Delta in the same manner as the Hetch Hetchy Project. This project stores and diverts the water of the Mokelumne River system to supply water for the East Bay Municipal Utility District. The Mokelumne River is a natural tributary to the Delta. This project has two storage reservoirs on the Mokelumne River -- Pardee Reservoir, with a maximum storage capacity of 210,000 acre-feet, and Comanche Reservoir, with a maximum storage capacity of 431,500 acre-feet.

Existing State Water Project

The key legislation for construction of the State Water Project was the State Water Resources Development Bond Act (Burns-Porter Act), ratified in the November 1960 general election. This act authorized the sale of $1.75 billion in general obligation bonds for primary financing. The project began service to the South San Francisco Bay area in 1962, to the San Joaquin Valley in 1968, and to Southern California in 1971.

State Water Project facilities extend from Plumas County in the north to Riverside County in the south. The Project was planned to deliver 4,230,000 acre-feet of water annually to service areas in Northern, Central, and Southern California. The 444-mile California Aqueduct, which begins at the Harvey O. Banks Delta Pumping Plant, is the principal conveyance facility of the project. The Project now includes 22 dams and reservoirs, 6 power plants, and 16 pumping plants.

The annual dependable yield of the State Water Project with existing facilities and water quality standards is about 2,300,000 acre-feet for the 1928-34 critical dry period. This yield is projected to decrease to about 1,700,000 acre-feet annually sometime between the year 2000 and the year 2020 as the result of increased use in areas of origin, maturity of contractual obligations of the Central Valley Project, and other prior rights.

The main storage facility is Lake Oroville, on the Feather River in Butte County. Other major facilities in the Oroville area are the Edward Hyatt Power Plant, Thermalito Diversion Dam, Thermalito Power Canal, Thermalito Forebay and Power Plant, Thermalito Afterbay, a fish barrier dam, the Feather River Fish Hatchery, and various recreation and wildlife areas.

Water releases made for fish propagation and other purposes, together with irrigation return flows, move down the Feather and Sacramento rivers and then into the Delta channels. These releases and unregulated flows of other tributaries are sufficient to meet current export requirements of the State Water Project, allowing reasonable deficiencies in agricultural supply during a critically dry period. By the mid-1980s, this will no longer be true because export requirements and upstream depletions will increase. Releases are augmented as necessary during low runoff periods to meet shortages in the Delta for internal uses and for salinity control and to protect the quality of export water. These flow augmentations are made in coordination with releases from Central Valley Project reservoirs when that project is being operated to meet Delta water quality standards.

The major conveyance facility of the State Water Project is the California Aqueduct, which diverts water from the Delta at the Harvey O. Banks Delta Pumping Plant and transports it southward for storage in the Federal-State San Luis Reservoir and for use by State Water Project water contractors in the San Joaquin Valley.

At the northern base of the Tehachapi Mountains, the A. D. Edmonston Pumping Plant lifts California Aqueduct water nearly 2,000 feet up the mountain. The water then crosses the mountains through a series of four tunnels. The aqueduct divides south of the Tehachapi Mountains. The West Branch transports most of the water through Pyramid Reservoir to Castaic Lake, northwest of Los Angeles. The East Branch delivers water to Antelope Valley and terminates at Lake Perris in Riverside County.

The 43-mile South Bay Aqueduct takes water from the California Aqueduct for delivery to water contractors in Alameda and Santa Clara counties.

The 96-mile coastal branch of the California Aqueduct was planned to deliver water to San Luis Obispo and Santa Barbara counties. The initial 16 miles has been built, making water available to two San Joaquin Valley water contractors.

Phase I of the North Bay Aqueduct was completed in 1968. Since then a temporary supply of water from the U. S. Bureau of Reclamation's Solano Project has been pumped by means of an interim pumping plant into the Phase I facilities and then delivered to Napa County.

A recent addition to the State Water Project was the enlarged John E. Skinner Delta Fish Protective Facility. The Department of Water Resources is proceeding with enlargement of this facility on the intake channel of the Harvey O. Banks Delta Pumping Plant, adjacent to Clifton Court Forebay.

Studies of the enlarged facility show that fish screen efficiencies will be improved significantly for striped bass, decreased slightly for chinook salmon, and unchanged for white catfish. The Department of Fish and Game found the enlargement will have an overall beneficial impact on the fisheries.

Although the enlargement will increase fish screening efficiencies, the Department of Fish and Game considers any salvage system in the south Delta inadequate because during much of the year fish in this major nursery area are too small to be screened with the louver system. Furthermore, the fish that are successfully screened must be handled and trucked to the western Delta; substantial losses occur due to handling and diverting the fish from their normal migration routes. According to the Department of Fish and Game, no screen at the present location could prevent exports from depleting fish populations and their food supply.

If the Peripheral Canal is not built, further design changes at the existing facilities will be considered. Experience gained in operation of the enlarged fish facility, particularly with use of perforated plates in the secondary system, should be helpful if redesign is necessary.

Existing Safeguards

A number of safeguards already protect Delta water quality. Federal and State agencies that issue regulatory permits for construction and operation of projects such as the North Bay Aqueduct are discussed in the Draft ES/EIR, Chapter 2, pages 7-10. Other specific safeguards discussed in Bulletin 76 (pages 28-29) include the following.

Delta Protection Act (1959)
(Water Code Section 12201 et seq.)

- Section 12201 recognizes both the needs of the Delta and the needs for exportation of water from the Delta to other parts of the State.

- Section 12202 states that the State Water Resources Development System, in coordination with operation of the CVP, shall provide salinity control and adequate water supply for users of water in the Delta.

- Section 12203 declares it to be "the policy of the State that no person, corporation or public or private agency or the State or the United States should divert water from the channels of the Sacramento-San Joaquin Delta to which the users within said Delta are entitled."

- Section 12204 reads: "In determining the availability of water for export from the Sacramento-San Joaquin Delta no water shall be exported which is necessary to meet the requirements of Section 12202 and 12203 of this Chapter."

Area-of-Origin Statutes
(Water Code Sections 10505 and 11460-11463)

- Declares the Delta to be part of the Sacramento River watershed.

- The area-of-origin legal concept sets forth restrictions and limitations to protect the water requirements of the county of origin or the watershed in which water originates.

- The protection grants the areas of origin the right to construct projects or make diversions without being subject to the prior rights acquired under the State applications for the SWP.

- "It also grants the Delta, and all other areas of origin, certain preferential rights to contract for project water within the general framework established in the State water supply contracts" provided that payment is made for benefits from the project.

State Water Resources Control Board Water Rights Appropriation Process
(Current Decision Affecting Central Valley Project and
State Water Project is Decision 1485)

- Establishes water quality standards for the Delta as a condition of appropriation permits issued to DWR and USBR for agricultural, municipal, and industrial uses and for fish and wildlife purposes.

- Requires control of the level of exports and releases from upstream storage reservoirs to meet minimum water quality at specific locations in the Delta.

- Requires DWR to establish a Delta water quality monitoring program.

- Reserves jurisdiction to revise or formulate additional terms and conditions in the water rights permits.

- Mandates a study of Delta freshwater outflow needs of the San Francisco Bay ecosystem.

- Requires an environmental impact report.

Porter-Cologne Water Quality Control Act and
Federal Water Pollution Control Act

- Require establishment of water quality control plans for water basins. The current Delta Plans were adopted by the State Water Resources Control Board when it adopted Decision 1485.

Fish, Wildlife, and Recreation Requirements
Established by the Legislature

- Point out that the California Water Code requires preservation and enhancement of fish and wildlife by the SWP.

- State that in planning water development projects, DWR must give full consideration to all beneficial uses of the State's water resources.

Constitution of the State of California

Requires that water supplies be used reasonably and beneficially.

Impacts of the North Bay Aqueduct

In 1978, Department of Water Resources Bulletin 76, "Delta Water Facilities", analyzed the operation of existing and proposed facilities (including the North Bay Aqueduct) of the State Water Project and the federal Central Valley Project. The analysis considered the needs of: (1) the State Water Project, (2) the Central Valley Project, (3) upstream diversions and storage made for

projects such as the Hetch Hetchy Project, Mokelumne River Project, agricultural irrigation, and other use, (4) Delta agricultural consumptive use, and (5) the Bay-Delta estuarine system. The evaluation used variations in historical hydrology that occurred between water years 1921-22 and 1970-71.

The unimpaired natural flow to the Delta averages about 30 million acre-feet per year. The average annual volume is divided between upstream use and project storage (about 9.4 million acre-feet), Delta needs (about 5.7 million acre-feet), project (CVP/SWP) exports (about 6.1 million acre-feet), and excess Delta outflows (about 9.4 million acre-feet). The total amount of unimpaired natural flow is more in wet years and less in dry years. A component changed by water development is total annual Delta outflow volumes in excess of minimum protective requirements (see page 13 of Bulletin 76 for charts showing Delta uses of water).

The major water-using component is the combined SWP/CVP projects. Areas served by the projects and the percentage of water delivered to such areas are also shown in charts on page 13 of Bulletin 76.

The North Bay Aqueduct diversion will have a minor incremental impact on Delta outflows and Sacramento River flow during uncontrolled flow periods. Uncontrolled flow periods occur when all Delta protective outflow requirements are being exceeded by unregulated natural inflow. This period normally includes winter and spring months when Central Valley runoff conditions are high. Uncontrolled flow periods last longer in wet years than in dry periods. The proposed North Bay Aqueduct diversion location will not significantly affect Delta flows in the San Joaquin River, Old River, and Middle River, which are now subjected to reversals from existing Central Valley Project and State Water Project exports. This proposed diversion can have a minor incremental impact on the fishery by diverting at the proposed sites. These impacts will be cumulative on the Bay-Delta estuary. In addition, the North Bay Aqueduct will incrementally add to the need for new project reservoirs. A reservoir will have local environmental impacts and growth-inducing impacts.

The Central Valley Project and State Water Project presently have average annual screened diversions of about 6.1 million acre-feet per year. Also, about 2,000 privately controlled unscreened diversions for agricultural irrigation divert about 1.6 million acre-feet per year. The North Bay Aqueduct maximum annual entitlement represents less than one percent of the total Delta diversions.

North Bay Aqueduct diversions will not reduce Sacramento River flows or Delta outflows during controlled flow conditions, which exist when Delta protective flows, as set by Water Right Decision 1485, are being maintained by project storage releases. The North Bay Aqueduct diversions will be replaced by project storage releases during periods of controlled flow. These releases are planned to guarantee Delta outflows to protect the Delta's environment and beneficial water use. These replacement releases will maintain necessary protective flow requirements for the Sacramento River and Delta estuary.

The ratio of North Bay Aqueduct diversion to the flow in the Sacramento River varies by month and year type. The North Bay Aqueduct maximum monthly diversion represents about 2 percent of the average April-June Sacramento River monthly flows during critical years. Critical years occur on the average of once every 10 years. In addition, the North Bay Aqueduct maximum diversion is

less than one percent of the average Sacramento River monthly flow. This ratio describes the percent of project storage releases necessary to replace North Bay Aqueduct diversions during controlled flow conditions. During July in a critical year, this ratio could be as high as 11.5 percent. The North Bay Aqueduct maximum monthly diversion is less than 0.5 percent of the average monthly uncontrolled Delta outflows of all year types. The above values are based on 1990-level operation studies using 50 years of historical hydrology as input.

The maximum incremental upstream storage that will be needed for the North Bay Aqueduct diversions represents less than one percent of current upstream storage volumes.

Impacts of Proposed State Water Project Facilities

Bulletin 76 established a program that would provide comprehensive protection for the Delta and the Suisun Marsh while meeting the year 2000 water needs of the Central Valley Project (CVP), State Water Project (SWP), non-CVP/SWP upstream use, and Delta consumptive use. Uses of Delta water and areas where CVP/SWP water is used are shown on pages 13 and 14 of Bulletin 76. The Bulletin 76 program, described in more detail below, includes the Peripheral Canal as a Delta transfer facility and an important means for improving the fisheries to average historical levels, storage reservoirs upstream and downstream from the Delta, Delta and Suisun Marsh protection facilities, and waste water reclamation, ground water, and conservation programs.

Water Needs

Bulletin 76 contains an operation study of the entire system of existing and proposed SWP and CVP facilities using 50 years of historical hydrologic conditions adjusted for the year 2000 level of development. The 50-year operation study results are shown by Figures 40 to 43 of Bulletin 76. These results show CVP and SWP systems operation, annual Delta water supply and disposal, typical flow and quality routing, and estimated monthly average quality for the year 2000 level of development. These are based on operation studies performed for the 50-year historical period.

Bulletin 76 showed a projected export demand by CVP/SWP project users of 7.7 million acre-feet annually by year 2000. This demand assumed 0.6 million acre-feet not needed because of conservation and waste water reclamation. Existing facilities could provide a firm yield of 5.2 million acre-feet. The Bulletin 76 program would supply 3 million acre-feet per year, increasing the projects' firm yield to 8.2 million acre-feet. This provides 0.5 million acre-feet as a contingency against forecasting uncertainties or that can be applied to increases in SWP demands beyond the year 2000 (see page 105). Annual variation of water supply and disposal for wet years is shown on page 106.

In the Bulletin 76 year 2000 studies with planned future facilities, Delta consumptive use was maintained at a constant 1.6 million acre-feet per year. Minimum Delta outflow required to meet water quality and fishery criteria averaged 3.6 million acre-feet per year, varying from a high of 4.9 million

acre-feet in a wet year to 2.2 million acre-feet in a critical year. Delta export averaged 7.6 million acre-feet per year, varying from a high of about 9 million acre-feet to a low of about 5.5 million acre-feet per year. The potential for intermittent surplus water export averaged about 350,000 acre-feet per year, with none being available in the drier years. Finally, excess freshwater Delta outflows averaged almost 7 million acre-feet per year, varying from a high of about 25 million acre-feet in the wettest year to very little in the driest year. These results were based on controls similar to Decision 1485 criteria.

Total Delta outflow, the sum of minimum required Delta outflow and excess Delta outflow, averaged 10.5 million acre-feet per year, varying from a high of 30 million acre-feet in a wet year to a low of about 2.2 million acre-feet in a critical dry year. Had the study been performed using the Delta Water Quality Plan currently in effect, the results would be similar.

Firm water deliveries of 7.7 million acre-feet were maintained in about 80 to 85 percent of the years, with the lowest delivery being 6 million acre-feet in a typical critical year. This was accomplished by withdrawing water from project storage -- both surface and underground -- south of the Delta and applying predetermined deficiencies to agricultural supplies in critical years.

Because each hydrologic year is different, the amount and timing of both export and releases from the Peripheral Canal would vary from year to year and from month to month. To demonstrate operation for projected year 2000 conditions, a typical diversion and release pattern for winter, spring, and summer conditions for a critical year (1934), above-normal year (1946), and wet year (1942) are shown in Figure 42 in Bulletin 76. Figure 43 of the Bulletin shows Delta water quality conditions at selected locations for a full 12-month period for each of the same three classifications of years.

The North Bay Aqueduct is included in this study as a proposed Delta diversion. The requests for entitlement water deliveries from the North Bay Aqueduct (shown in Table 13 of the bulletin) amount to 54,000 acre-feet in year 2000 with a maximum annual entitlement of 67,000 acre-feet. This requested entitlement delivery for the year 2000 used for this operation study is larger than the projected supplemental M&I water needs shown in Table 3-3(F) of the Final ES/EIR. Since the bulletin operation study uses a larger diversion, it will have conservative results in connection with the North Bay Aqueduct diversions. The maximum annual entitlement has not been changed for the Final ES/EIR.

Figure 23 of Bulletin 76 compares North Bay Area maximum annual entitlements to other SWP contracting agency entitlements. Table 13 shows SWP contractors' requests for entitlement deliveries in 1990 and 2000. A summary of the North Bay Aqueduct and other SWP and CVP Delta export requirements and capabilities to the year 2000 is shown on Table 19 and Figure 25 of the bulletin. The potential shortages in supplies noted on Figure 25 will be offset by new storage facilities. These facilities and the additional firm annual yield that can be developed are shown on Table 29. These values are for a year 2000 level of development.

If the Bulletin 76 program is instituted:

° The fisheries would be restored to average historical levels.

° Current or improved salinity control would occur.

° Suisun Marsh would obtain full protection.

° A number of storage reservoirs would be built, causing local adverse impacts.

° Unregulated flows would be decreased.

If the Bulletin 76 program is not implemented (or if only parts are implemented), demand could be more than yield, thus requiring greater deficiencies to be taken by CVP/SWP contractors in dry and critical years. Impacts on fisheries and on salinity control will depend on what other alternatives, if any, are instituted, and what actions the State Water Resources Control Board may take regarding Bay-Delta standards. Impacts may also occur from other projects not included in the Bulletin 76 analysis.

Delta Protection

The 50-year operation study showed that the year 2000 Delta export demand of 7.7 million acre-feet per year could be met while providing all area-of-origin requirements and a comprehensive Delta protection program. This comprehensive protection includes meeting the specified Delta salinity and environmental criteria and project operational constraints listed in Tables 4 and 5 of Bulletin 76. These criteria and operational constraints provide protection for:

° Western Delta agricultural applied water (with or without overland supplies).
° Interior Delta agricultural applied water.
° Southern Delta agricultural applied water.
° Delta agricultural flushing requirements.
° Contra Costa Canal municipal and industrial water use.
° Vallejo municipal and industrial water use.
° Western Delta municipal and industrial water use.
° Striped bass spawning and survival.
° Minimized diversion of young striped bass from the Delta.
° Minimized diversion of young striped bass into the central Delta.
° Salmon migration.
° Steelhead.
° Neomysis shrimp.
° Suisun Marsh.

Although some changes in water management planning have occurred since Bulletin 76 was published, these differences will not change the overall findings of the bulletin's analysis. The differences are attributable to changes between the proposed and adopted legislation (SB 346 and SB 200), adoption of Water Rights Decision 1485 by the State Water Resources Control Board. SWRCB requirements in SB-346 were the 1975 Basin Plan standards.

Bulletin 76 reviewed the effects of the 1978 Basin Plan standards, which were included in Decision 1485, and determined that the effects were similar. SB-200 does not set standards, but requires compliance with SWRCB standards. Senate Bill 346 of 1977 added all the facilities and actions of the DWR program outlined in Bulletin 76 to the State Water Project and spelled out the legislative intent regarding the need for them. However, SB 346 did not pass in the State Legislature.

Senate Bill 200, signed by the Governor on July 18, 1980, provides nearly the same facilities and objectives as SB 346 and Bulletin 76. One of the most significant differences between SB 200 and SB 346 is federal participation in the Peripheral Canal. SB 346 would have prohibited construction of the Peripheral Canal until the Federal Government agreed: (1) to comply with SWRCB water quality standards; (2) to participate in agreements to guarantee restoration of fish and wildlife populations to historical levels; and (3) to contract with Delta agencies regarding guaranteed levels of water quality. SB 200 allows construction of the Peripheral Canal by the State without prior federal participation but would allow for federal participation at any time. However, it restricts the transport of federal water through SWP facilities unless the Federal Government agrees to comply with water quality standards and restoration of fish and wildlife populations to historical levels.

In addition, SB 200 provides a major Delta guarantee by requiring the SWP to make water releases to rectify any federal failure to operate the CVP in compliance with SWRCB water quality standards. SB 200 assures that such agreement will be made for protection of Delta agricultural interests and assures that water deliveries to SWP contractors will not be obstructed by Delta agencies' refusal to negotiate by requiring binding arbitration if the Delta agencies and DWR do not negotiate agreements on minimum water quality and quantity standards. SB 200 prohibits construction of the Peripheral Canal unless an agreement is signed between the Department of Fish and Game and the Department of Water Resources to preserve and, if possible, enhance fish and wildlife while operating the SWP. An agreement for this protection has been drafted and an environmental document is being prepared to finalize this agreement. SB 200 provides for a comprehensive study of San Francisco Bay. Information from the study will be used by the SWRCB to assure that future exports and diversions to storage in new reservoirs named in SB 200 will not take water needed to protect the Bay.

In 1981, a referendum measure qualified SB-200 to be submitted to a vote of the people. That vote will occur in June 1982.

Specific protection measures and a water management plan for the SWP are discussed in pages 78-85 of Bulletin 76. Major proposed facilities to be incorporated into the plan are listed below, with some updated information.

Delta and Suisun Marsh Facilities

Proposed Additional Pumping Units at the Harvey O. Banks Delta Pumping Plant. The Department of Water Resources proposes to install and operate four additional pumping units at the Harvey O. Banks Delta Pumping Plant. The four units would increase pumping capability to the full rated design capacity of

10,300 cubic feet of water per second (cfs). The seven pumps now installed have a capability of 6,300 cfs. The Department is preparing a draft Environmental Impact Report for these pumps.

Proposed Peripheral Canal and Fish Screen Protection. The Peripheral Canal has been selected over the nonisolated alternatives as the most effective facility to transport water across the Delta for the SWP and CVP and still provide the necessary environmental and water quality protection for the Delta. The Peripheral Canal would release fresh water to Delta channels at strategic locations for Delta use, water quality control, and fish. Canal releases would provide positive downstream flows in Delta channels and would contribute to the Delta outflow required for protection from salinity intrusion. By eliminating reverse flows in the western Delta, this facility would reduce the amount of carriage water presently needed for increased project yield.

The canal route is along the eastern rim of the Delta and extends 42 miles from Hood, on the Sacramento River, to Clifton Court Forebay near Tracy, at the southern edge of the Delta. Outlets along the way would provide for release of fresh water into the Delta. The canal would be siphoned under four major river and slough crossings to allow for passage of floodflows, boats, and migrating fish. Floodflows from Morrison Creek drainage and Middle River would be accepted into the canal. Cross-drainage flows in the area of Beaver, Hog, and Sycamore sloughs would be siphoned under the canal.

Section 6100 of the California Fish and Game Code requires fish screens on any new diversion from any stream having salmon and steelhead if such diversions would adversely affect these fish. The Department of Fish and Game has determined that the Peripheral Canal would have to include an adequate fish screen.

The fish protection facilities at the Banks Pumping Plant and the federal Tracy Pumping Plant use a system that guides the fish along louvers (vertical slats) into a bypass that carries them to holding tanks. The salvaged fish are periodically transported to release sites in the Delta away from the influence of the pumping plants. Tests have shown, however, that small fish are not screened efficiently and that many salvaged fish die due to handling and transporting.

The four agencies (Department of Water Resources, Department of Fish and Game, U. S. Bureau of Reclamation, and U. S. Fish and Wildlife Service) participating in the Interagency Ecological Study Program for the Sacramento-San Joaquin Estuary are considering a system for Delta water transfer facilities that would require all diverted water to flow through a screen that will exclude small fish. The system consists of plates (or rotating drums) with small holes and an approach structure large enough to permit low flow velocity through the screen. The Peripheral Canal would include a screen at the intake facility that would allow the screened fish to return to the Sacramento River without being handled.

The canal would be constructed in three stages. Stage 1 would be an operational stage, 24 miles long, from Hood to Shima Tract. Stage 2 would be a preconsolidation stage, 15 miles long, over predominantly peat soils from

the San Joaquin River to Clifton Court Forebay. Stage 3, 18 miles from Shima Tract to Clifton Court, would include completion of Stage 2 and construction of the 3-mile gap between Shima Tract and the San Joaquin River.

As part of Stage 1, the fish screen and pumping plant would be completed to about one-fourth of their design capacity for use during a two-year testing period to verify fish screen design criteria and operational release criteria. Completion of Stage 1 would increase the export yield of the State Water Project and Central Valley Project by about one-third of the canal's ultimate yield, thereby reducing the risk of water shortages in project service areas during the testing period.

Stage 3 would not be built until the Directors of both the Department of Water Resources and the Department of Fish and Game determine from test results that the fish screen and operational criteria are adequate to protect fish populations in conformity with the Two-Agency Fish and Wildlife Agreement.

Suisun Marsh Facilities. As mitigation for past, present, and future adverse impacts of reduced Delta outflows on the wildlife resources of Suisun Marsh, the Department will (or will contract with Suisun Resources Conservation District to) construct, maintain, and operate the Suisun Marsh overall facilities.

The overall facilities planned for protection of Suisun Marsh include: Roaring River Slough, Morrow Island distribution system, Goodyear Slough outfall, Montezuma Slough control structure, Grizzly Island distribution system, Potrero Hills Ditch, Cygnus Ditch, Cordelia-Goodyear Ditch, Goodyear Slough control structure, and Boynton-Cordelia Ditch.

Initial facilities constructed include Roaring River Slough, Morrow Island distribution system, and Goodyear Slough outfall. The remaining overall facilities are scheduled for completion by October 1984.

The Department's Central District has prepared a "Plan of Protection for Suisun Marsh Including Draft Environmental Impact Report". This report, dated September 1980, contains a detailed discussion of the Suisun Marsh facilities.

Relocation of the Contra Costa Canal. The Contra Costa Canal intake would be relocated to divert water from Clifton Court Forebay, subject to the terms of a contract between the Department of Water Resources and beneficiaries.

South Delta Facilities. South Delta water quality improvement facilities would consist of pumping plants, discharge canals, flow control structures, and channelization of sloughs to improve circulation, distribution, and quality of water in the southeastern Delta and to meet the needs of the southern Delta area. These facilities would be completed no later than the Peripheral Canal.

Western Delta Overland Facilities. Western Delta overland water facilities would supply water to agricultural areas on Sherman Island, Jersey Island, Hotchkiss Tract, and adjacent areas.

Components North of the Delta

Glenn Reservoir Diversion Unit. Glenn Reservoir River Diversion Unit would be on the west side of the Sacramento Valley in the vicinity of Stony Creek and Thomes Creek watersheds. This unit may be built in stages. The Department of Water Resources is preparing environmental documentation (EIR) on a small version of Glenn called Thomes-Newville. If the Glenn Reservoir unit is infeasible (as determined by the Director of Water Resources), the Colusa Reservoir River Diversion Unit on the west side of the Sacramento Valley in the western portion of Glenn and Colusa counties would be its alternative. This unit could also be built in stages. The Sites Reservoir portion of the unit may be developed at any time by the Federal Government as a facility of the Central Valley Project to serve the Tehama-Colusa Canal and any extension thereof into Yolo and Solano counties.

Cottonwood Creek Project. The program includes the authorized Corps of Engineers Cottonwood Project, which is comprised of two tributary storage reservoirs, Dutch Gulch and Tehama. Dutch Gulch Reservoir on Cottonwood Creek would be formed by a dam 268-feet high and would have a capacity of 1.1 million acre-feet. Tehama Reservoir on the south fork of Cottonwood Creek would be formed by a dam 238-feet high and would have a gross storage capacity of 900,000 acre-feet.

The project would provide substantial flood control benefits along Cottonwood Creek and in downstream areas along the Sacramento River as well as local irrigation, recreation, and fish enhancement benefits. However, the largest benefits would be derived from municipal and industrial water supply for the SWP.

Components South of the Delta

Waste Water Reclamation. Waste water reclamation programs would provide yield for the State Water Project, provided such facilities are economically competitive with alternative new water supply sources.

Water Conservation. Water conservation programs within the boundaries of agencies that have contracted for water from the SWP would provide that implementation of such programs be contingent upon contracts between such agencies and the Department of Water Resources. Based on Department of Water Resources estimates, waste water reclamation and water conservation in urban areas served by SWP facilities will total about 700,000 acre-feet annually by the year 2000.

Los Vaqueros Unit. The Los Vaqueros Unit would be located in eastern Contra Costa County about 8 miles west of Clifton Court Forebay. Other offstream storage reservoirs may be located south or west of the Delta, as determined by the Director of the Department of Water Resources, to be served by existing project facilities.

Los Banos Grandes Off-Stream Storage Reservoir. Los Banos Grandes Reservoir is an alternative to Los Vaqueros Reservoir. Using the California Aqueduct to transport surplus Delta flows that generally occur during the winter and spring, this reservoir would store such flows for later use during dry periods. It would have more storage capacity and produce somewhat more yield than the Los Vaqueros project, but it would not provide the same operational flexibility to the CVP and SWP as Los Vaqueros.

For example, it could not serve water to all areas between the Delta and San Luis Reservoir during periods of reduced exports; it could not serve as a reserve emergency supply for Contra Costa County Water District; and, as proposed, available flows to fill the reservoir would have to compete for space in the California Aqueduct with water for filling San Luis Reservoir and for ground water storage. In essence, it would operate as an enlargement of San Luis Reservoir.

Los Banos Grandes Reservoir would be in the hills just south of San Luis Reservoir. It would be formed by a dam 460-feet high on Los Banos Creek and four saddle dams that would provide a reservoir with a capacity of 2.2 million acre-feet.

Ground Water Storage Facilities. Facilities would be built for using ground water storage space determined by the Director to be feasible for providing yield for the State Water Resources Development System based on DWR estimates that ground water storage can yield 400,000 acre-feet annually. These facilities would operate in conjunction with existing and future surface water supplies by recharging and extracting ground water and would include the capitalized cost of delivering water for filling or refilling ground water storage space in one or more of the following locations within the service area of the State Water Resources Development System: (1) the South San Francisco Bay area in Santa Clara and Alameda counties, served by the South Bay Aqueduct; (2) San Joaquin Valley, served by the California Aqueduct; (3) Southern California, served by the California Aqueduct, including enlargement of the Devil Canyon Power Plant and the Mojave Division (East Branch) from the proposed Cottonwood Power Plant to Silverwood Lake.

None of the designated ground water facilities (above) shall be constructed or operated within the boundaries of an agency that has contracted for water from the State Water Resources Development System without a contract with such agency.

Transport Facilities

Mid-Valley Canal. The Mid-Valley Canal Unit would be built primarily to alleviate the ground water overdraft and to provide water supplies for State and Federal waterfowl management areas in the canal service area.

Transport Facilities. Facilities would be provided to transport water to San Joaquin, San Francisco, San Mateo, Alameda, and Contra Costa counties.

Coastal Branch Extension. The extension of the Coastal Branch of the California Aqueduct has been planned to deliver water to San Luis Obispo and Santa Barbara counties. This 80-mile extension to the two coastal counties has been postponed indefinitely because of a March 1979 vote in Santa Barbara County against a bond issue to deliver SWP water.

Impacts of Proposed Federal Projects

Various proposed federal projects are noted in Bulletin 76 and are described below.

Auburn Dam, a major dam under construction, is on the North Fork of the American River upstream of Folsom Reservoir. The completion date of this facility, which would be part of the Central Valley Project's Auburn-Folsom South Unit, is uncertain. The reservoir would supplement Folsom Lake in providing:

- Flood control.
- Power generation.
- Water for use in Folsom South Canal service area.
- Fish and recreation flows in the American River.
- Delta inflows and exports.

Two major conveyance facilities of the Central Valley Project are under construction:

- The Tehama-Colusa Canal, in the western Sacramento Valley.
- The Folsom South Canal, which is only partially completed because of its relationship to Auburn Dam.

The San Felipe Division, under construction, will serve portions of Santa Clara, San Benito, Santa Cruz, and Monterey counties from the San Luis Reservoir with water exported from the Delta.

Impacts of Other Facilities

San Joaquin Valley Drain. The need for agricultural drainage facilities in the San Joaquin Valley has been recognized by State and Federal agencies for

many years. Natural drainage is inadequate and the installation of a subsurface drainage system is required to maintain permanent productivity on certain irrigated lands in the valley. In 1979, the San Joaquin Valley produced more than 50,000 acre-feet of agricultural waste water and by the year 2000 it is expected to produce more than 400,000 acre-feet per year. In December 1980, the Department of Water Resources completed studies of the land area required to dispose of drainage water by evaporation. Results showed that 110,000 acres would be needed by the year 2000 and 153,000 acres by the year 2020 to dispose of the drainage water generated by development expected at those times.

The Interagency Drainage Program (IDP) was organized as a combined effort of the U. S. Bureau of Reclamation (USBR), the State Water Resources Control Board (SWRCB), and the Department of Water Resources (DWR) to plan an environmentally, economically, and politically acceptable drainage program that would meet the needs of the San Joaquin Valley. In June 1979, IDP presented a plan for conveyance and disposal of saline agricultural subsurface drainage effluent, with recommendations for implementation and financing. The plan calls for construction of a State and Federal drainage canal (Valley Drain) along the length of the San Joaquin Valley trough. The Valley Drain would collect the saline effluent of on-farm subsurface drainage systems for eventual disposal in the tidal water of Suisun Bay near Chipps Island. A 82-mile segment of the Valley Drain constructed from Kings County to Kesterson Reservoir in Merced County serves as the first segment of the proposed 290-mile drain alignment.

USBR has asked SWRCB to establish discharge requirements for the drain at Chipps Island. SWRCB would need 3 or 4 years before it would be able to issue discharge requirements. Additional studies would be required by USBR in toxicity impacts on aquatic organisms, bio-stimulation, environmental impact avoidance and mitigation measures, salinity standards, and dissolved oxygen depletion to establish appropriate waste discharge requirements.

At hearings held in 1980 by the Senate and Assembly Committees on San Joaquin Valley drainage, the water contractors recognized the need for the drainage but the landowners were reluctant to contract now to guarantee repayment for drainage service that would not be needed for 20 years or more. At the hearing, Delta representatives were opposed to the drain discharge into Delta-Bay waters. The Committees recognized that it would be difficult to formulate an acceptable program that will both accommodate opposition in the Delta and meet the needs for drainage in the San Joaquin Valley.

The Governor's Executive Order B-68-80 directed DWR to prepare a plan of water reclamation and directed management of the State Water Project to implement a program of recycling agricultural drainage and other brackish water to augment project water supplies.

A primary objective of the planning process for the San Joaquin Valley drain was to minimize unavoidable adverse impacts. The first stage environmental impact report for this project discloses potential adverse impacts of the Recommended Plan and describes how they would be avoided or mitigated. It also discloses unavoidable, unmitigable adverse impacts. The major conclusions are:

- Discharge of year 2000-level drainage at Chipps Island (drainage from Tulare Lake Drainage District and Kern County excluded) would not cause widespread salinity increases in the western Delta-Suisun Bay area. Minor salinity increases near the discharge point may require mitigation.

- Implementation of the recommended plan would not cause signficant impacts on algal growth in the Delta or Suisun Bay, although nitrate removal might prove necessary to ensure this.

- A drain serving areas north of the Tulare Lake Drainage District is not expected to affect aquatic life of the receiving waters. Due to arsenic content, drainage from certain areas in the Tulare Lake Drainage District and Kern County may not be acceptable for discharge.

- The Valley Drain would cause small reductions in streamflow and salinity of the San Joaquin River compared to existing conditions. The recommended plan would prevent further water quality degradation caused by subsurface drainage.

- Minor impacts would result from the siting of canals, pipelines, evaporation ponds, regulation reservoirs, and marshes. Indirect impacts might result from future reuses of the drain water, such as for power plant cooling.

Desalting, one alternative to disposal of agricultural drainage, can reduce the waste water by 80 to 90 percent. The 10 to 20 percent remaining in the form of brine from the desalting plant will contain most of the original salt load, and must be disposed of either by evaporation in ponds, discharging to the ocean, or through the Valley Drain into the Delta. A pilot desalting plant near Firebaugh in San Joaquin Valley is being used to investigate the feasibility of desalting agricultural drainage and other brackish water. Construction of other desalting plants would depend on successful results at the pilot plant.

Sacramento River and Stockton Deep Water Channels. In 1965, Congress authorized the San Francisco Bay to Stockton Ship Channel Project (also known as the John F. Baldwin and Stockton Ship Channel Project). The project involves deepening the Stockton Deep Water Channel from 30 feet to 35 feet, realigning the channel to follow False River, constructing a new turning basin and maneauvering area, constructing public recreation areas and facilities along the route, and placing rock revetment on levees along the channel. However, only limited construction has been accomplished on this project pending evaluation of the effects of deepening the Stockton Ship Channel.

Local interests requested enlargement of the Sacramento River Deep Water Ship Channel. In response to the request, the Corps of Engineers investigated the feasibility of deepening the Sacramento River Deep Water Ship Channel and released a "Draft Feasibility Report and Draft Environmental Impact Statement for Navigation and Related Purpose" on Sacramento River Deep Water Ship Channel.

The contemplated channel improvements could expose the Delta to increased salinity intrusion, which in turn could result in a need to increase the minimum Delta outflow necessary to meet salinity control criteria established by the State Water Resources Control Board and approved by the Environmental

Protection Agency. The Department of Water Resources indicated that any increase in salinity in the Delta channels was unacceptable and that the Corps of Engineers should accept responsibility for providing restoration flows to repel any increase caused by the ship channel projects.

Mitigation for the ship channel improvement project has been addressed that will minimize Delta impacts. Mitigation of increased salinity intrusion would be a project cost. Specific mitigation methods may be implemented for:

° Impacts upon agricultural uses of water. Mitigation would involve application of additional river waters to maintain saturation of the root zones of crops, an accepted method for maintaining crop production under saline conditions, the added water being required to leach salts from the critical zone.

° Impacts on municipal and industrial water quality. The river diversion for Bay-Delta M&I uses would be relocated upriver to Clifton Court Forebay. This measure would be only partially effective because full restoration would depend upon operation of a Peripheral Canal or a similar type of cross-Delta diversion structure.

° Salinity impacts on the Bay-Delta ecosystem. Model studies of a submerged sill (at an elevation below improved channel depth) located in a naturally deeper channel reach have proved beneficial in limiting the amount of salinity level increase. However, preliminary results indicated that salinity intrusion can only be partially mitigated by the submerged sill. An adjustable channel closure gate would be investigated in an effort to seek a more effective control over salinity level increases. However, it does not appear that base salinity conditions can be entirely maintained under project conditions.

Mitigation Measures

If Senate Bill 200 is not passed in June, a variety of paths may be followed. Some of the facilities included in the bill are already authorized by existing legislation (i.e., Glenn Reservoir) and may be built anyway. Others, such as the Peripheral Canal, are uncertain. Other Delta transfer facilities discussed in Appendix B of Bulletin 76 may be substituted. Although none of them could achieve the level of restoration enabled by the Peripheral Canal, some could significantly increase existing levels and provide sufficient yield to meet contractor needs. Alternatively, it is possible that no transfer facility would be built, which would probably result in an inability to meet contractor needs.

Existing Measures

As noted in the section on existing projects, existing protection measures provide assurances that before water can be diverted from the Delta by State and Federal projects, Delta and other area-of-origin users' needs must be met. State Water Resources Control Board controls through the appropriation and water quality protection processes provide, through Decision 1485, water quality standards in the Delta and Suisun Marsh and require various monitoring

programs, which the CVP and SWP must meet and carry out. SWRCB maintains continuing jurisdiction over the projects and has changed and will change the order based on new projects and information. Projects other than the CVP and SWP must also go to the SWRCB if the project involves appropriation of water.

SWP Proposed Mitigation Measures

Senate Bill 200 includes a number of mitigation measures. In November 1980, the people of California passed Proposition 8, which becomes effective only if Senate Bill 200 becomes effective following the June 1982 vote. Proposition 8 strengthens a number of the Senate Bill 200 protections and adds new ones. The mitigation measures in Senate Bill 200 and Proposition 8 include:

Senate Bill 200:

° Requires that the Peripheral Canal and other facilities of the SWP as a whole be operated to restore fisheries to historical levels (1922-67). This would not only mitigate for impacts caused by the SWP, but also the CVP and other deliveries.

° Provides for limitations on Delta exports necessary to restore and maintain historical levels of fish and wildlife.

° Requires staged construction of the Peripheral Canal to facilitate extensive testing of the fish screen and a determination of its adequacy before completing the canal.

° Clarifies that the SWP must be operated to meet SWRCB water quality standards to protect the Delta, Suisun Marsh, and San Francisco Bay and requires the SWP to guarantee Federal compliance with such standards.

° Requires the Department of Fish and Game and other State agencies to make a comprehensive joint study of San Francisco Bay fish and wildlife and their needs for Delta outflows, including "flushing flows".

° Assures adequate quantity and quality of water to continue a high level of agriculture in the Delta by requiring Department of Water Resources to enter into permanent and enforceable contracts with Delta agencies that will recognize water user rights and establish water quality criteria that will have priority over Delta export.

° Provides for improved water quality in southern Delta channels currently degraded by poor quality San Joaquin River inflow and internal irrigation return flows.

° Provides for a year-round high quality water supply to Contra Costa Water District.

° Provides an inducement to the Federal Government to comply with SWRCB standards it argues it is not required to meet and to enter into an agreement to restore the fisheries by prohibiting new transfer of federal water until they do agree to comply with the standards and to enter into an

agreement. This is important because the federal project is nearing the limit of its transfer capacity, although it still has water to sell.

° Authorizes reclamation and water conservation programs.

° Requires a study of the Bay to provide information for the SWRCB to set standards for Bay protection.

Proposition 8:

° Limits the Legislature's authority to amend or repeal provisions of SB 200 relating to the protection of fish and wildlife, water rights, and water quality by requiring a vote of the people to change them.

° Limits the Legislature's ability to amend or repeal provisions of the Delta Protection Act by requiring a vote of the people to change them.

° Prohibits public agencies from using eminent domain proceedings to acquire water rights in the Sacramento-San Joaquin Delta for the purpose of exporting such water from the Delta.

° Limits the Legislature's ability to export water to other basins from rivers designated under the State Wild and Scenic Rivers Act by requiring a vote of the people or a two-thirds vote of the Legislature to authorize such exports. Current law only requires a majority vote of the Legislature.

Other Department of Water Resources Mitigation Measures

As a result of Executive Order B-68-80, the Department of Water Resources is working with its contractors to establish conservation plans that would defer the need for water. Such plans will also include potential waste water reclamation and conjunctive use programs. Programs for the North Bay Aqueduct contractors are already included in the preferred alternative in this Final ES/EIR to be implemented through institutional means. Plans are being prepared for all contractors and are expected to be completed by December 1982. It is also possible that the SWRCB would encourage conservation efforts through the water rights process.

If Senate Bill 200 is not ratified by the people, other measures will need to be considered. Other Delta transfer facilities would improve the fisheries situation, although they would not be capable of restoring populations to historical levels (Appendix B of Bulletin 76). Improved fish screens and facilities could also reduce fishery losses.

In building reservoirs, the Department of Water Resources would engage in a variety of mitigation measures, including:

° Fish -- Hatchery construction, adjustment of reservoir releases, habitat modification, screening, establishment of reservoir fishery.

° Wildlife -- Purchase of replacement lands, capture and removal of species, control fencing, escape devices.

° Social Economic -- Payment of increased public services caused by project workforce.

° Cultural -- Avoidance or removal of identified cultural resources where possible, purchase of private property where necessary.

° Recreation -- Construction of recreational facilities.

° Soils -- Reestablishment of native vegetation, erosion control techniques employed, replacement of soil and topography where possible.

° Transportation -- Relocate existing roads and railroads.

° Utilities -- Relocate existing utilities.

Other Mitigation Measures

Other project owners and proponents could do a variety of things to reduce cumulative impacts in the Delta and at reservoir sites. These include:

° Adoption of water conservation, waste water reclamation, and water transfer programs.

° Growth control ordinances near reservoir sites.

° Measures discussed for the State Water Project with regard to reservoir sites.

Mitigation for the North Bay Aqueduct

The Department of Water Resources will also provide important mitigation for fishery impacts at the North Bay Aqueduct diversion by implementing urban water conservation programs for North Bay Aqueduct water users. The possible conservation measures for these plans are described in Appendix I and the plans are in Appendices II and III. Negotiations are now in progress to finalize these programs that are reasonable, practical, economically achievable, and enforceable. The measures outlined in these plans will extend contracted entitlement buildup schedules and correspondingly delay the North Bay Aqueduct annual diversion increases.

The Department of Water Resources will commit to studies that will provide more information in connection with impacts to fish eggs and larvae caused by North Bay Aqueduct diversions. Current information and discussions with the Department of Fish and Game indicate that these impacts would be minor. If the future studies determine that mitigation is required, the Department will provide the mitigation needed to offset the impact. Possible methods to mitigate impacts to fish eggs and larvae are: (1) limitation of North Bay Aqueduct diversions between April and June, (2) additional modification of the planned Two-Agency Fish Agreement to increase fish populations to adjust for

study finding, (3) additional modification of State Water Project storage and export operations to provide benefits for fish, and (4) project funding allocations to reduce Delta system egg and larvae losses from nonproject activities.

Response 2

Information on water needs and alternatives presented in Chapter 3.0 of the Draft ES/EIR has been revised. (See Section 1.) The information demonstrates the need for the project and revises the preferred alternative to include incorporation of an urban water conservation plan in the North Bay Aqueduct service area.

Response 3

In addition to the discussion of cumulative impacts presented in the Draft ES/EIR (Section 6.3 and Appendix F), Bulletin 76, published by the Department of Water Resources in 1978, contains a thorough review of water management activities affecting the Delta ecosystem. (See Response 1.)

Response 4

The revised analysis of water conservation presented in Section 1 considers the industrial and commercial sector.

Response 5

The SWP-CVP operation study described in Response 1 shows how necessary releases to the Sacramento River can be made to protect the Delta and meet future water project demands. This is shown for 50 years of historical hydrology applied to a year 2000 level of SWP and CVP export requirements, upstream depletions, Delta depletions, and implementation of proposed facilities listed in Table 29 on page 105 of Bulletin 76. The operation study was also discussed in Response 1.

The proposed facilities or comparable facilities will be needed to assure future operations as described in Bulletin 76. Future Delta protection is provided for by the safeguards described in Response 1. The SWP service contracts provide for the possible supply shortages that would occur if SWP water development could not develop the necessary facilities.

The general provisions of all State Water Project water supply contracts address the possibilities of temporary and permanent supply shortages. A temporary shortage of State Water Project water supplies can occur in any year when a drought or other temporary cause reduces project water available for delivery to the contractors to less than the total annual entitlements of all State Water Project contractors for that year. The Project will then be operated to reduce deliveries of that year's annual entitlement used for agricultural purposes by a percentage not to exceed 50 percent in any one year or a total of 100 percent of yearly annual entitlements in any series of seven

consecutive years. The maximum total reduction in deliveries allowable under the above provision will be made before any reduction is made in Project water deliveries for other uses. If necessary, further reductions will be made to all Project water deliveries, irrespective of use, and the reduction will be proportional to the entitlement.

A permanent shortage can occur to reduce contracted entitlements in the event that the State is unable to construct sufficient additional conservation facilities to prevent a reduction in the minimum State Water Project yield or if, for any other reason, there is a reduction in the minimum State Water Project yield that, notwithstanding preventive or remedial measures taken or to be taken by the State, threatens a permanent shortage in the supply of State Water Project water. Reductions for these shortages will be proportional to entitlements.

Response 6

The Department of Water Resources would exercise principal authority over aqueduct construction and will provide for these mitigation measures to the extent possible. The Department has, in fact, already completed comprehensive water quality studies. The findings of the water quality studies are contained in "Investigation of Cause of Increase in Chloride Concentration at Proposed North Bay Aqueduct Intake in Cache Slough", published by DWR's Central District in July 1981. (See Response 8 to comment letter from The Resources Agency of California.) Documented damage of subsurface irrigation and drainage systems will be properly corrected by the Department. (See Section 3, Corrections and Additions to the Draft ES/EIR, section 6.1.1.5.)

Response 7

Correction noted; see Section 3 for changes to the Draft ES/EIR.

Response 8

Correction noted; see Section 3 for changes to the Draft ES/EIR.

Response 9

The Final ES/EIR has used the most current population projections developed by the State Department of Finance in its E-150 series, adjusted for the 1980 census. (See Section 1, Table 6-2(F).)

Response 10

The Association of Bay Area Governments and the Sacramento Area Council of Governments are unable to undertake consistency determinations at this time (see attached letters).

11b DEC 8 1981

Association of Bay Area Governments

Hotel Claremont · Berkeley California 94705 · (415) 841-9730

December 4, 1981

Mr. Michael Zander
Madrone Associates
23-B Pamarron Way
Novato, CA 94947

RE: Draft Environmental Statement/Environmental Impact Report for the North Bay Aqueduct (Phase II Facilities)

Dear Mr. Zander:

You recently requested information from ABAG concerning population growth associated with the North Bay Aqueduct DES/EIR in relationship to the latest air quality plan. Specifically, EPA has indicated that the Final ES/EIR should include an ABAG certification that the project and its induced growth are consistent with the latest Non-Attainment Area Plan.

Since the 1982 Non-Attainment Area Plan has neither been produced nor adopted, we are not able to undertake a consistency determination. However, we are able to determine that the population projections used for the project do not conform with the population projections being used in developing the 1982 Bay Area Plan (i.e., ABAG's Projections 79). Attachment A is a comparison of the respective population projections. Once the 1982 Plan and its associated analyses have been produced, it may be possible to address this issue more directly

Sincerely,

Ron Wada

Ron Wada
Air Quality Program Manager

Enclosure

Attachment A

North Bay Aqueduct

Year	Projections 79 Solano	Napa	[illegible]
1980	224,894	102,165	[illegible]
1985	258,123	[illegible]	
1990	299,608	118,389	[illegible]
1995	335,595	123,784	
2000	363,793	129,354	[illegible]
2010	--	-	[illegible]
2020	--	--	[illegible]

SACOG

Sacramento Area Council of Governments

Directors

Members

November 12, 1981

Mr. Michael Zander
Madrone Associates
23-B Pamaron Way
Novato, CA 94947

Re: Draft Environmental Impact Report
North Bay Aqueduct
(Phase II Facilities)

Dear Mr. Zander:

I have reviewed the subject DEIR, focusing on the population impacts of the proposed project. More specifically, I attempted to determine the consistency of the project and its impacts with the Sacramento 1982 *Air Quality Plan (AQP)*. *To be frank, it is* not possible for me to determine if the project is consistent with the AQP. The following is an explanation of why this is so.

- Page 1 of the DEIR states that the project would supply water to Vacaville, Fairfield, Suisun City, Benicia, Napa and Vallejo.
- None of the jurisdictions listed above are in the SACOG area. Only Vacaville is in the Sacramento *Air Quality Maintenance Area* and is, *therefore*, involved with the SACOG-prepared AQP (see attached map).
- Although Vacaville is in the Sacramento Air Quality Maintenance Area, no population data for Vacaville were used by SACOG for air quality planning. Generally, population data were only developed for the Sacramento air quality modeling grid area. As shown on the attached map, Vacaville is not in the modeling grid area.
- Since population projections for Vacaville were never used in the development of the AQP, it is not possible to determine what level of population increase would be consistent with the AQP.

Although it is not possible for me to determine the consistency of the proposed project with the AQP, the following points should be noted.

Mr. Michael Zander
November 12, 1981
Page 2

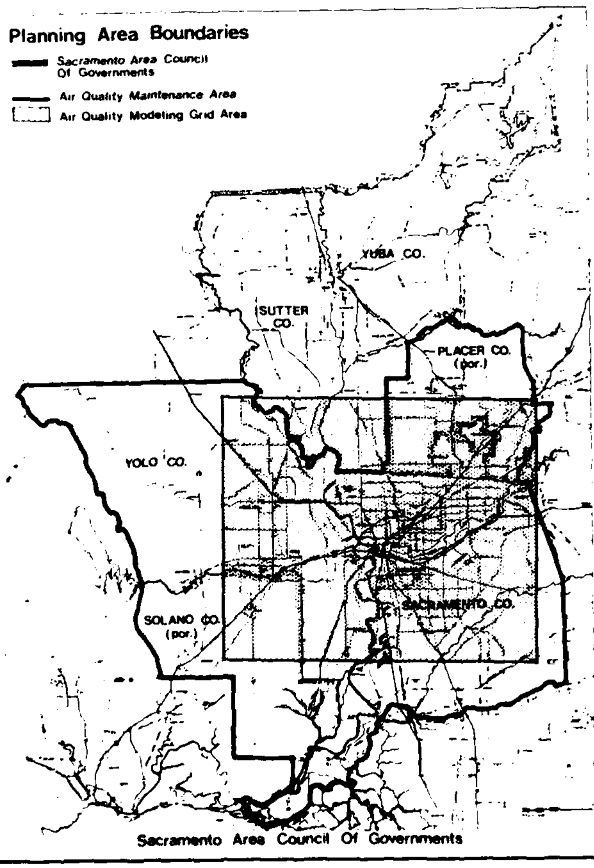
- It is possible that the Association of Bay Area Governments or the Metropolitan Transportation Commission have developed useful population projections for some or all of the affected jurisdictions in connection with the Bay Area AQP. We discussed this matter during our telephone conversation.
- It is possible that when the Sacramento AQP is brought before the Vacaville City Council, some set of population projections could be adopted on a policy basis as part of the Sacramento AQP. It may then be possible to determine [illegible] the proposed project with the Sacramento AQP.
- Since the emissions produced by the affected jurisdictions are generally transported into the Sacramento area, SACOG would support any measures that would reduce pollutant emissions in this upwind area.

If you have any further questions, please call me at [illegible]

Sincerely,

WAYNE SHI[illegible]
Associate Planner

WS:pal
Attachment



Based on local General Plans and personal communication with planning staff, Solano County projects a population of 326,000 for 1990. This is somewhat lower than the most recent State Department of Finance estimates of 342,400, on which NBA water demand calculations are based (see Table 6-2(F)). Based on the 1975 General Plan, Napa County projects a population of 115,000 for the year 2000. The most recent State Department of Finance estimate is 113,200 (see Table 6-2(F)). The latter estimate is an increase of only 14,100 over the present county population. Therefore, maximum demand for the North Bay Aqueduct supply will not be realized until well beyond the year 2000 in Napa County.

Response 11

Correction noted; see Section 3 for changes to the Draft ES/EIR.

Response 12

Correction noted; see Section 3 for changes to the Draft ES/EIR.

Response 13

Correction noted; see Section 3 for changes to the Draft ES/EIR.

Commenting Entity: United States Department of Agriculture
Forest Service
July 7, 1981

Comment noted.

Commenting Entity: National Marine Fisheries Service
August 5, 1981

Response 1

The Draft ES/EIR has been corrected to indicate that Cache Slough and Lindsey Slough are likely to be equally sensitive with respect to fishery resources. (See Section 3 and Response 2.)

Response 2

New information for the Final ES/EIR includes important mitigation for fishery impacts at the North Bay Aqueduct intake and additional research findings on

Delta fisheries. The Department of Water resources is negotiating with North Bay Aqueduct water contractors to insure future urban water conservation programs. This water conservation will extend contract entitlement buildup schedules and correspondingly delay the annual diversion increases for the North Bay Aqueduct. The delay in diversions will reduce fishery impacts.

Information made available since publication of the Draft ES/EIR indicates that Cache Slough would likely be equally sensitive to anadromous fish as would Lindsey Slough. Recently published research by Ecological Analysts for Pacific Gas and Electric Company ("Pittsburg Power Plant Cooling Water Intake Structure 316(B) Demonstration", November 1981) shows that migrating juvenile striped bass are widespread in Delta sloughs and channels and are not confined to the main channels. However, there is no bass spawning in the area of the intake (Cache or Lindsey Sloughs) and only those eggs and larvae dispersed by tidal effects could reach the North Bay Aqueduct intake. Tidal dispersed eggs and larvae that could reach the intake would be from the Sacramento River system, which supports about half of the Delta's egg and larvae population. The impacts to the eggs and larvae from North Bay Aqueduct diversions are estimated by the Department of Water Resources and the Department of Fish and Game to be minor. If future information shows that impacts are significant, then limiting North Bay Aqueduct diversions in addition to reductions from conservation will be investigated during periods when eggs and larvae are present.

Several operational mitigation measures for the North Bay Aqueduct will offset cumulative impacts. The Department of Water Resources will commit to:

° Future coordinated planning with interested agencies to operate project reservoir storage, monthly export rates, and daily off-peak and on-peak export pumping to benefit the fishery. (See correction for page 142, paragraph 6.1.2.9.2.)

° Urban water conservation programs for Solano and Napa counties to extend contracted entitlement buildup schedules and correspondingly delay North Bay Aqueduct annual diversion increases. (See correction for page 142, paragraph 6.1.2.9.2.)

° Protective fish screens at the intake.

° Studies to determine specific information on the numbers of fish eggs and larvae that will be affected by the aqueduct diversions. Current information and discussions with the Department of Fish and Game indicate that this impact will be minor.

° Additional mitigation action for fish eggs and larvae if future studies show the need for additional action. The Department of Water Resources will provide mitigation for possible significant impacts to fish eggs and larvae at the North Bay Aqueduct diversion by possible measures or combinations of measures such as: (1) diversion limitation for the Aqueduct between April and June, (2) modification of the planned Two-Agency Fish and Wildlife Agreement criteria to increase fish populations, (3) modification of State Water Project operations to benefit fish, and (4) project funding allocations to enhance fish hatchery activities.

Although dead-end sloughs along the Sacramento River, such as Cache Slough, have relatively high water turbidity and net reverse flows in the summer, juvenile striped bass tend to concentrate in the sloughs during spring and early summer.

Dead-end sloughs are generally favorable to juvenile bass because the water temperatures rise earlier in the year. The early temperature increase allows phytoplankton populations, which form the base of the food chain, to increase sooner. The juvenile bass feed on zooplankton, which increase in numbers closely following the phytopklankton "bloom". A high level of water pumping can affect the net residence time of water in adjacent sloughs. This can result in reduced populations of free-swimming invertebrates such as copepods and Neomysis shrimp, important food sources of juvenile bass. As the juvenile fish continue to grow, they cease feeding on zooplankton and migrate farther downstream, eventually reaching ocean waters. The research performed for Pacific Gas and Electric Company in the area of Cache and Lindsey Sloughs indicates that larval and juvenile striped bass populations reached maximum size from April through early June in 1977 and 1978.

Juvenile salmon are larger (30 mm) and tend to stay in the main channels by the time they reach the Cache Slough area. But, according to Dan Odenweller of the California Department of Fish and Game, they would be present in large numbers in the area of the intake sites (Cache and Lindsey Sloughs) when the Yolo Bypass floods. This expanse of land receives excess water from the Sacramento River during heavy runoff periods; when the water returns to Cache Slough near the junction with Lindsey Slough, it contains large numbers of salmon fry. The proposed screens should prevent 30-mm fish from passing through. These screen designs consider flow velocities.

Response 3

See Response 2. Information made available since publication of the Draft ES/EIR indicates that the impact would be similar at either intake location. The baseline information at the selected intake would also include entrainment studies necessary to refine design of the diversion screening facilities. Calhoun Cut will probably have the same fishery impacts as the Sacramento Deep Water Channel, and has not been considered as an intake location.

Response 4

The new fishery information provided in Response 2 and the development of mitigation measures to reduce possible impacts at the intake show that selection of the intake site is appropriate at this time.

Response 5

In addition to the discussion of cumulative impacts in the Draft ES/EIR, Department of Water Resources Bulletin 76 (July 1978) contains a thorough review of water management activities and future projects affecting the Delta. (See Response 1 to U. S. Environmental Protection Agency comment letter.) Fishery resources are discussed in Chapter 3.0 of Bulletin 76. Bulletin 76

contains information on the cumulative Delta effects of all projects, the need to insure future Delta protection, and future SWP-CVP export needs. Other tentative projects, such as work on the Sacramento Deep Water Ship Channel, PG and E's plant at Collinsville, and the San Joaquin Valley salt drain are not evaluated in Bulletin 76. However, these projects must fully comply with all Delta safeguards described in Response 1 to the U. S. Environmental Protection Agency comment letter and in Bulletin 76. This compliance will be outlined in the environmental documents required before construction of these projects can begin.

Studies for the authorized John F. Baldwin Ship Channel improvement project have been extensive and still further research is required before an acceptable plan can be developed. Results of studies have and will continue to change the nature of the plan of development, which was approved by Congress more than a decade ago.

At this time, planning of the project has been delayed about four years to complete a Delta Environmental Water Quality Study and to evaluate the effects of disposing of large quantities of dredged material into Bay waters.

Mitigation for the ship channel improvement project has been addressed that will minimize Delta impacts. Mitigation of increased salinity intrusion would be a project cost. Specific mitigation methods may be implemented for:

° Impacts upon agricultural uses of water. Mitigation would involve application of additional river waters to maintain saturation of the root zones of crops, an accepted method for maintaining crop production under saline conditions, the added water being required to leach salts from the critical zone.

° Impacts on municipal and industrial water quality. The river diversion for Bay-Delta M&I uses would be relocated upriver to Clifton Court Forebay. This measure would be only partially effective because full restoration would depend upon operation of a Peripheral Canal or a similar type of cross-Delta diversion structure.

° Salinity impacts on the Bay-Delta ecosystem. Model studies of a submerged sill (at an elevation below improved channel depth) located in a naturally deeper channel reach have proved beneficial in limiting the amount of salinity level increase. However, preliminary results indicated that salinity intrusion can only be partially mitigated by the submerged sill. An adjustable channel closure gate would be investigated in an effort to seek a more effective control over salinity level increases. However, it does not appear that base salinity conditions can be entirely maintained under project conditions.

More information is provided in an U. S. Army Corps of Engineers report, "San Francisco Bay to Stockton, California, Project (San Francisco Bay to Point Edith Region) Environmental and Economic Status Report", August 1978.

A primary objective of the planning process for the San Joaquin Valley drain was to minimize unavoidable adverse impacts. The first stage environmental impact report for this project discloses potential adverse impacts of the Recommended Plan and describes how they would be avoided or mitigated. It

also discloses unavoidable, unmitigable adverse impacts. The major conclusions are:

- Discharge of year 2000-level drainage at Chipps Island (drainage from Tulare Lake Drainage District and Kern County excluded) would not cause widespread salinity increases in the western Delta-Suisun Bay area. Minor salinity increases near the discharge point may require mitigation.

- Implementation of the recommended plan would not cause signficant impacts on algal growth in the Delta or Suisun Bay, although nitrate removal might prove necessary to ensure this.

- A drain serving areas north of the Tulare Lake Drainage District is not expected to affect aquatic life of the receiving waters. Due to arsenic content, drainage from certain areas in the Tulare Lake Drainage District and Kern County may not be acceptable for discharge.

- The Valley Drain would cause small reductions in streamflow and salinity of the San Joaquin River compared to existing conditions. The recommended plan would prevent further water quality degradation caused by subsurface drainage.

- Minor impacts would result from the siting of canals, pipelines, evaporation ponds, regulation reservoirs, and marshes. Indirect impacts might result from future reuses of the drain water, such as for power plant cooling.

SWP contractors have indicated little interest in solving the San Joaquin Valley drainage problem. Kern County interests have been particularly negative. The Department of Water Resources does not intend to begin construction of these facilities until a repayment program is assured, following Governor Edmund G. Brown's contracting principles of 1960. In addition, complicated contracting principles need to be resolved, as well as cost-sharing agreements between the State and Federal Governments. More information is available in Department of Water Resources Bulletins 132-80 and 132-81.

No plans are available for Pacific Gas and Electric Company's plant at Collinsville. No aquatic environmental evaluations have been completed for this plant. There is no active planning for this plant.

To further guarantee protection and enhancement of the Delta ecosystem, the Department is negotiating an agreement with the California Department of Fish and Game to manage fish and wildlife resources in the Sacramento-San Joaquin estuary. The draft memorandum of agreement, issued in January 1981, calls for the Department of Water Resources to consult and cooperate with the U. S. Bureau of Reclamation and for the Department of Fish and Game to consult and cooperate with the U. S. Fish and Wildlife Service and the National Marine Fisheries Service. The memorandum is being prepared in compliance with Senate Bill 200, which required the agreement before commencing construction of newly authorized SWP facilities. One of the principal goals of the agreement is to restore fish and wildlife resources in the Delta to historical levels.

Under provisions of Senate Bill 200, construction of the Peripheral Canal cannot begin until the Department of Water Resources and the Department of

Fish and Game enter into a permanent agreement for the protection and enhancement of fish and wildlife. The agreement must provide for:

° Restoration and maintenance of adult populations of fish and wildlife at historical levels in the Delta, Suisun Marsh, and San Francisco Bay system.

° Maintenance at historical levels shall consider natural fluctuations in annual water supply and populations of fish and wildlife.

° Those limitations on exports and diversions to storage necessary to restore and maintain historical levels of fish and wildlife.

° Fresh water needed (to the extent practicable) to restore and maintain fish and wildlife in the San Francisco Bay system to be provided from unregulated flows.

° Realization of the potential of the project for increasing these resources above historical levels consistent with the contracts for water delivery and with other purposes of the projects.

Senate Bill 200 was signed by the Governor in July 1980 and was to become effective in January 1981. A referendum on the bill was qualified by opponents to the Canal; the bill will not become effective unless ratified by the people in the June 1982 primary election.

Response 6

The ratio of the North Bay Aqueduct diversion to the flow in the Sacramento River would represent about 11.5 percent of the minimum monthly flow of the Sacramento River at Rio Vista for the month of July in a critical year as set by the State Water Resources Control Board in Water Rights Decision 1485. For April-June of the critical years, the average ratio of North Bay Aqueduct diversions to Sacramento River flows, as computed by operation studies of actual historical hydrology would be only 2 percent. Critical years occur on the average of once every 10 years. Furthermore, the North Bay Aqueduct diversions represent only 0.7 percent of average Sacramento River flows and only 0.002 percent of wet year flows. In critical years and during summer months, the Delta is normally under controlled flow conditions. During this controlled condition, all North Bay Aqueduct diversions will be replaced by releases from project storage and therefore protective Sacramento River flows will be maintained. Delta flow and quality criteria established to protect the Delta will take priority over North Bay Aqueduct diversions. (See Response 5 above, and Response 1 to comment letter from the U. S. Environmental Protection Agency.)

Response 7

Comment noted. The preferred alternative includes adoption of reasonable and enforceable urban water conservation programs for Napa and Solano counties as proposed by the Department of Water Resources.

Response 8

The use of pricing policy studies to reduce water consumption is addressed in the Department of Water Resources' recommended urban water conservation plans (Appendices II and III). These plans recommend that existing pricing policies be reviewed. Information on reuse of agricultural drainage water presented in Chapter 3.0 of the Draft ES/EIR has been updated in the Final ES/EIR. (See Section 1.) The investigation of reuse of agricultural drainage water for the Final ES/EIR determined that the current potential was 10.000 acre-feet per year greater than estimated in the Draft ES/EIR.

Commenting Entity: U. S. Department of the Interior
July 12, 1981

Response 1

See Responses 1 and 2 to National Marine Fisheries Service (U. S. Department of Commerce) letter.

Response 2

As is customary in California, contacts with the State during the cultural resources evaluation of the North Bay Aqueduct alignment were made through the California Archaeological Site Survey Regional Office at California State University, Sacramento. In accordance with 36 CFR 800.4 (Advisory Council on Historic Preservation Procedures, "Protection of Historic and Cultural Properties: Final Amendments", determination of eligibility for the National Register of Historic Places), identification of archeological sites along the preferred alignments was made in consultation with SHPO (see Response 3 below).

Response 3

Procedure 36 CFR 800.4 requires the conducting of studies necessary to provide a review of the effect a project may have on a National Register or eligible property, as well as the information necessary for adequate consideration of modifications or alterations to the project that would avoid, mitigate, or minimize any adverse effects. The State Historic Preservation officer must be consulted with regard to these matters and the officer's recommendations should be followed. If the property is found to be a National Register or eligible property, the Advisory Council on Historic Preservation must be consulted.

A preliminary survey of archeologic and historic areas potentially falling within aqueduct alignments was completed in July and August 1980 by David Chavez, consulting archeologist associated with the California Archeological Site Survey Regional Office at California State University, Sacramento (see

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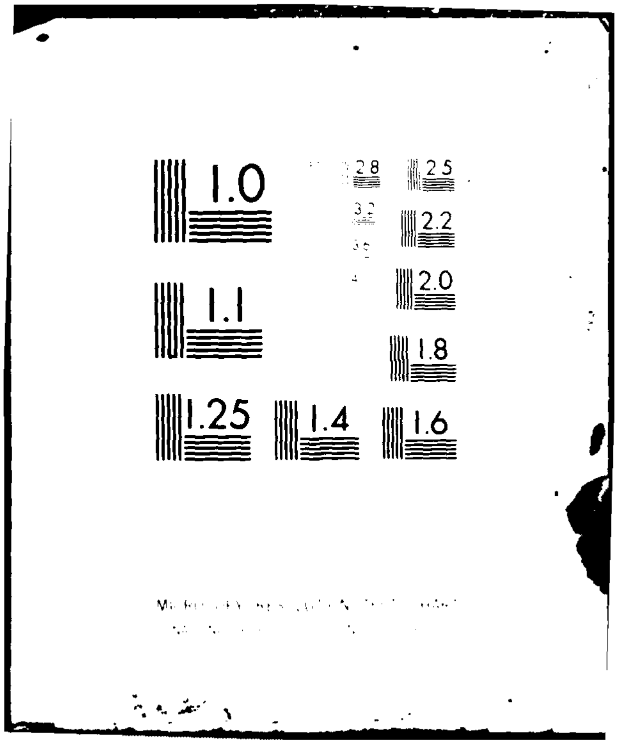
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Appendix E, Draft ES/EIR). This survey identified two resources within the alignment of the preferred alternative Route 1.

One of these sites -- Site CA-Sol-268 -- was a partially destroyed prehistoric archeological site identified in 1977. The 1980 survey inspection of the site resulted in the detection of some obsidian flakes and shell. While the site appeared to be relatively small and badly damaged, the 1980 survey concluded there could be substantial subsurface deposites that could be of regional significance and, therefore, the site should be avoided or if it could not be avoided, it should be subject to a data recovery program. In December 1981, the site was subjected to a subsurface archeological testing program, which led to the conclusion that no subsurface archeological deposits exist at the location. Further, close scrutiny of the surface in the overall site locale resulted in the detection of only a very few obsidian flakes, leading to the conclusion that no archeological site deposits of sufficient density are present at the location to warrant further investigation. The consultant concluded that the site would not likely be eligible for inclusion on the National Register of Historic Places, that regional and local importance of the site perished with the destruction of the resource, and that no further action regarding the site was recommended (see Appendix IV, Final ES/EIR). The State Historic Preservation Office has concurred with the conclusion (see Appendix IV).

The preliminary survey also identified a historic site consisting of rock fence segments dating from the late 1800s. The consultant concluded that although these fences were of regional significance, they were not eligible for the National Register of Historic Places. The consultant recommended avoiding the fence by going through an existing break in the fence, by trenching under the fence, or by removing by hand the portions necessary for building the aqueduct and rebuilding the fence after completion of the aqueduct. The conclusion and recommendation of the consultant has been discussed with the State Historic Preservation Office (Mr. Michael Rondeau, personal communication, May 18, 1982). The office was asked for a written concurrence. The Department of Water Resources agrees to commit to designing the aqueduct alighment to pass through the existing break in the fence for the Route 1 alignment. The aqueduct alignment in the vicinity of the fence will probably be moved to coincide with planned subdivision street alignments. This move will be about 2,000 to 3,000 feet in an easterly direction and will avoid the fence. (See Response 19 to this letter.)

An additional Historic Archeological Site was identified for the Routes 4 and 6 alignments. If one of those routes is selected, the Department will follow the recommendation of the consultant and design the aqueduct alignment so as to avoid the historic resource. This could be accomplished by establishing the actual pipeline alignment about 100 feet to the north of the resource location.

Response 4

Correction noted; see Section 3 for corrections to the Draft ES/EIR.

Response 5

The relationship of the North Bay Aqueduct to the SWP and CVP is discussed in Section 6.1.2.3 of the Draft ES/EIR, in DWR Bulletin 76 (July 1973), and in Response 1 to U. S. Environmental Protection Agency comment letter. There will be no effect on the Central Valley Project water supply as planning studies show.

Response 6

Information on alternative water supply sources, including waste water reclamation, in Chapter 3.0 of the Draft ES/EIR has been updated and is included in Section 1.

Response 7

The statement referred to the fact that the North Bay Aqueduct Phase II facilities would provide Napa County with a net increase of 17,500 acre-feet because the 7,500 acre-foot Solano Project supply is interim.

Response 8

Comment noted. (See Section 1, under Solano Project Reanalysis.)

Response 9

The quality of water discharged via a pipeline to Carquinez Strait could range between 50,000 and 100,000 ppm TDS, depending on plant size. (See Section 1, under Desalination of Suisun Slough.)

Response 10

Comment noted. (See Section 1, under West Sacramento Valley Canal.)

Response 11

Comment noted. (See Section 1, under Waste Water Reclamation.)

Response 12

Under the requirements of Section 7 of the Endangered Species Act of 1973, as amended, any activity of a federal agency that might affect federally listed threatened or endangered species requires consultation with the U. S. Fish and Wildlife Service (FWS) to determine if the species are present and if the activity will jeopardize the continued existence of these species. Field work to determine rare and endangered plant and animal species along two proposed alignments (Routes 1 and 4) of the North Bay Aqueduct was

conducted in 1979 and 1980 (see Appendix D of the Draft ES/EIR). FWS is reviewing the report to determine the suitability of various project alternatives. This report, which constituted an inventory of listed endangered and threatened species that required consideration for the North Bay Aqueduct project, was requested by the U. S. Army Corps of Engineers on January 14, 1980, and was provided to them on February 11, 1980.

Based on this biological assessment, the Corps of Engineers determined that the North Bay Aqueduct project will not affect any listed endangered or threatened species. This determination is presented in a letter from Jay K. Soper, Chief, Engineering Division, San Francisco District, U. S. Army Corps of Engineers, to Ralph Swanson of the U. S. Fish and Wildlife Service, dated February 23, 1982. This letter also requests that the Endangered Species Office of the U. S. Fish and Wildlife Service evaluate the biological assessment.

Response 13

Correction noted; see Section 3 for corrections to the Draft ES/EIR.

Response 14

Correction noted. See Section 3 and Responses 1 and 2 to National Marine Fisheries Service comment letter.

Response 15

A recent trapping study in the Cordelia Slough area (Study of the Salt Marsh Harvest Mouse in Suisun Bay, California, prepared by Howard S. Shellhammer, Ph.D., October 1980) indicated that the salt marsh harvest mouse was not present there. Overall trapping success was poor throughout Suisun Marsh, indicating relatively low densities of this endangered species. The Marsh provides generally poor habitat for the mouse.

Response 16

Comment noted. If other routes are selected as a preferred alternative, additional archaeologic survey work will be conducted.

Response 17

Correction noted; see Section 3 for corrections to the Draft ES/EIR.

Response 18

Correction noted. Use of the word "flushing" is inaccurate and misleading.

Response 19

Excavation for the Cordelia Forebay will displace about two acres of grazing land. The North Cordelia Forebay site is upland pasture; the South Cordelia Forebay site is a diked wetland area that is seasonally flooded. Cordelia Forebay will be an open-water reservoir designed to hold about 15 acre-feet of water. Average depth of the reservoir will be 10 feet. The reservoir may be lined with compacted clay to prevent percolation, and marginal vegetation will be discouraged. Although waterfowl may be attracted to the reservoir, the forebay will not provide suitable wildlife habitat. Any rafting or grouping of waterfowl would not create significant problems (e.g., no aircraft approach routes are located in the immediate vicinity of either forebay site).

Local subdivision planning near the North Cordelia Forebay will require some changes in the forebay location and the section of the aqueduct 36-inch pipeline that connects the forebay to the Cordelia surge tank. This surge tank is the beginning of the Phase I facilities of the North Bay Aqueduct. The planned relocation will move the forebay and section of aqueduct about 2,000 to 3,000 feet in an easterly direction. The section of pipeline will be aligned to correspond to street systems in the proposed subdivisions. This section is about 8,400-feet long. The relocated forebay will displace land that is probably similar to the land type displaced by the North Forebay location described in the Draft ES/EIR.

Cultural resources in the area of the planned relocation of the forebay and 36-inch aqueduct section have been investigated. The findings of the investigation are listed in Appendix E of the Draft ES/EIR and in Appendix IV of the Final ES/EIR. Important sites in this area include:

° CA-Sol-268, a prehistoric archaeological site located within the alignment corridor section between Interstate Highway 80 and the Cordelia surge tank. A detailed investigation of this site conducted for the Final ES/EIR concluded that these archaeological resources are no longer a critical resource issue. The State Historic Preservation Office in Sacramento agreed with this finding.

° Rock Fence Segments, historic features located within the alignment corridor section between Interstate Highway 80 and the Cordelia surge tank. The segment of the rock fence that transects this corridor likely dates from the late 1800s, when numerous such fences were constructed to mark boundary lines and serve as stock fences. This feature will be avoided by the planned relocation of the North Forebay and 36-inch aqueduct line.

° Unnamed Historic Ranch Cluster, on Green Valley Road. This site will be avoided by the planned relocation.

Response 20

Comment noted. Screening of major water diversions is required by State law. This is added as a planned mitigation measure in the Final ES/EIR.

Response 21

Known archaeological resources (i.e., site CA-Sol-268) along the preferred route have been subjected to detailed field examination (Appendix IV).

Response 22

The Department of Water Resources is committed to implementing all mitigation measures described in this paragraph as they relate to the preferred route.

Response 23

Comment noted. The preferred alternative is a buried pipeline. If an open canal alternative were constructed, a roughened canal surface would be created. The mitigation requiring escape ramps is designed to enable both small and large animals to pass through fenced areas along the canal.

Response 24

See Response 2 to National Marine Fisheries Service comment letter.

Response 25

Comment noted. The wildlife referred to would be primarily waterfowl.

Response 26

See Responses 1 and 2 to National Marine Fisheries Service comment letter. The baseline information would include entrainment studies necessary to refine design of the diversion screening facilities.

Commenting Entity: U. S. Department of Transportation
August 12, 1981

Response 1

Comment noted. Continual contact with the California Department of Transportation (Caltrans) will be maintained during project development.

Response 2

Comment noted. Federal Highway Administration approval will be obtained for any encroachment of Interstate route right of way by the project.

Response 3

In the process of final design, DWR engineers and right of way representatives typically meet with local agencies to agree on traffic control plans. The agreement is usually a permit that explicitly states the obligations of the Department's contractors as to traffic control, detours, etc. If such an agreement between the Department and the local agency is not formulated, the construction contractor must obtain any required roadway permits. No matter what route is selected, the impacts and mitigation measures will apply; therefore the specifics are not needed at this time. (See also Draft ES/EIR, page 131, section 6.1.1.2, and page 133, sections 6.1.1.4 and 6.1.1.5, as corrected in Section 3 of the Final ES/EIR.

Response 4

Construction haul routes are determined by the construction contractor after construction has commenced. Generally, haul routes make maximum use of existing roadways and rights of way. As discussed in the Draft ES/EIR (paragraph 6.4.4), the intake location of Routes 2 and 2A is more isolated than the other two potential intake locations with respect to existing roadways and would require development of new access roads. (See also Draft ES/EIR, page 131, section 6.1.1.2, and page 133, sections 6.1.1.4 and 6.1.1.5, as corrected in Section 3 of the Final ES/EIR.)

Commenting Entity: Federal Energy Regulatory Commission
(San Francisco), July 13, 1981

Comment noted.

Commenting Entity: Federal Energy Regulatory Commission
(Washington), July 21, 1981

Comment noted.

Commenting Entity: United States Coast Guard
August 7, 1981

Response 1A

Applications for intake and outfall pipelines will be filed with California Department of Boating and Waterways. These pipelines will be marked in accordance with the State Waterway Marking System.

Response 1B

The Department of Water Resources will seek approval from the Coast Guard prior to crossing the tidal portion of any waterway by overhead pipes or bridges.

Commenting Entity: Advisory Council on Historic Preservation
August 12, 1981

Response 1

See Response 1 to comment letter by Office of Historic Preservation, California Department of Parks and Recreation.

COMMENTS AND RESPONSES

STATE AGENCIES

Resources Building
1416 Ninth Street
95814

(916) 445-5656

Department of Conservation
Department of Fish and Game
Department of Forestry
Department of Boating and Waterways
Department of Parks and Recreation
Department of Water Resources

EDMUND G. BROWN JR
GOVERNOR OF
CALIFORNIA

THE RESOURCES AGENCY OF CALIFORNIA
SACRAMENTO, CALIFORNIA

Air Resources Board
California Coastal Commission
California Conservation Corps
Colorado River Board
Energy Resources Conservation and Development Commission
Regional Water Quality Control Boards
San Francisco Bay Conservation and Development Commission
Solid Waste Management Board
State Coastal Conservancy
State Lands Commission
State Reclamation Board
State Water Resources Control Board

Mr. [illegible] MacRostie, Chief
Central District
Department of Water Resources
3251 S Street
Sacramento, CA 95816

August 12, 1981

Dear Mr. MacRostie:

The State of California has reviewed the draft environmental statement/environmental impact report, North Bay Aqueduct (Phase II Facilities), Solano County, submitted through the Office of Planning and Research. This review, in accordance with OMB Circular A-95 and the National Environmental Policy Act of 1969, was coordinated with the Energy and State Lands Commissions, the Reclamation and Water Resources Control Boards, and the Departments of Boating and Waterways, Conservation, Fish and Game, Parks and Recreation, Health, and Transportation.

1 The Department of Fish and Game (DFG) comments that the report does not adequately describe the design, construction, and operation of fish screens at the aqueduct intake. The final report should fully describe the anticipated screen structure, together with cleaning devices and fish handling facilities, if any. Operation of the screen should also be described.

2 DFG also states that an adequate analysis of the project's effects on fishery resources is not possible until information is available on project operation. The final report should contain information on diversion rates on a monthly basis and the daily operational scheme. Project operations that limit diversions from the Delta during the April through June period would minimize effects on fish, especially salmon and striped bass. Reduced diversion during that period should be investigated in relation to the contracting agencies' water needs and alternative supplies.

3 With any alternative, there will be increased channel velocities in either Lindsay Slough or Calhoun Cut near the intake. The effect of increased velocities on fish and riparian habitat should be studied.

4 Safeguards similar to those in D 1485 for the Peripheral Canal with regard to fish screens should be included. If fish screens prove ineffective during the peak out migration of striped bass and salmonids, then pumping could be curtailed as necessary.

5 DFG also urges that potential fish and wildlife [illegible] be included where feasible. Examples may be at the [illegible] areas, along the right-of-way, or by adding [illegible] water [illegible] creeks along the route.

6 The possible mitigation measures (Section [illegible], page [illegible]) [illegible] be incorporated into the planned mitigation measures [illegible].

Questions regarding [illegible] Hunter, [illegible] Manager, DFG, P.O. [illegible], Yountville [illegible].

The Department of Conservation has the following comments:

7 The project's proposed mitigation measures for seismic hazards are not adequate without specification of the degree of such hazards which are insufficiently described in the report's geology and seismicity sections. The mitigation measures do not specify the amount of fault rupture and the degree of ground shaking which are needed for design considerations.

The Department suggests that the following information [illegible]:

1. Lists of historic regional earthquakes with magnitude, [illegible], and probable causative fault.
2. Maximum probable and credible earthquakes for each fault [illegible] capable of causing earthquakes.
3. Maximum probable and credible bedrock acceleration expected [illegible] facilities alongthe aqueduct system.
4. Maximum probable and credible bedrock effect of [illegible] tion with the proposed facilities.
5. The causitive fault for the April 19 and 21, 1892, Vacaville-[illegible]-Dixon earthquakes.

Questions regarding these comments should be directed to Perry [illegible], Advisory Services Officer, at (916) 322-3119.

The Department of Health Services has expressed concerns in two areas:

8 1. Water quality should be an important criterion within the site selection process. The conclusion that can be drawn from the draft report is that Lindsay Slough is superior to Cache Slough in this regard. Cache Slough exceeds Title 22 maximum contaminent levels for iron and manganese. Unfortunately, such data for Lindsay Slough was not available. Cache Slough also has a history of siltation problems and highly turbid water. Vallejo's water treatment plant at Travis AFB has experienced high turbidity from raw water received from Cache Slough.

Of greater concern are the watersheds which drain into the respective sloughs. Section [illegible].2.1.3.[illegible] of the draft report referred to a recent Solano County study which reports that the Vacaville watershed which drains into Cache Slough has a number of existing and potential problems. Cited were ineffective septic systems, erosion, siltation, debris, and litter accumulations in streams, and possible spills from toxic chemical operations. Only erosion was cited as a problem in the Rio Vista watershed, which drains [illegible] into Lindsay Slough. In addition, projections of future pollutant loadings indicate that Cache Slough will show greater increases than will Lindsay Slough.

9 2. The limited hydraulic data available indicates that both sloughs have problems with "flood" flows exceeding "ebb" flows due to agricultural withdrawals and other losses. This means that a backflushing problem exists in both sloughs which is highly unfavorable. Vacaville intends to discharge secondary treated wastewater to the slough not chosen for the aqueduct. Since backflushing occurs in both sloughs it is inevitable that some of this wastewater will find its way into both sloughs. To minimize this adverse impact, the slough with the least net water quality loss (e.g., agricultural, evaporation, groundwater seepage) should receive preference in the selection process. A secondary factor would be total water quantity within a slough for purposes of dilution. The draft report does not generate specific conclusions about the hydrologic characteristics of Cache and Lindsay Sloughs. This matter should be addressed before a site is selected.

Questions regarding these comments should be directed to Chuck Steinbergs, Sanitary Engineering Section, 2151 Berkeley Way, Room 224, Berkeley, CA 94704 or (415) 540-2152.

10 The Reclamation Board comments that if the selected route is one of the several proposed routes that has either Cache or Lindsay Sloughs as the intake point, the construction of a pumping plant and/or other facilities may necessitate encroachments on the levees under the jurisdiction of the Reclamation Board. If it appears that the implementation of this project will entail any alteration of these levees, a permit from the Board will be required before any construction may begin.

11 The Department of Boating and Waterways comments that the final report should include findings regarding the project's impact on navigation and boating safety at the water-pumping station sites. The Department also recommends that the applicant be aware of the requirements for placement of waterway markers. A copy of the applicable sections of Title 14 of the California Administrative Code.

We appreciate having been given an opportunity to review this report.

Sincerely,

James W. Burns

JAMES W. BURNS
Assistant Secretary for Resources

(SCH 79110117)

STATE OF CALIFORNIA — BUSINESS AND TRANSPORTATION AGENCY — EDMUND G. BROWN JR., Governor

DEPARTMENT OF TRANSPORTATION
P.O. BOX 2048 (1976 E. CHARTER WAY)
STOCKTON, CALIFORNIA 95201

August 10, 1981

10-Sol-12,80,113
ES/EIR for North Bay Aqueduct
(Phase II Facilities)

U.S. Army Engineer District, San Francisco
211 Main Street
San Francisco, CA 94105

Attn: Barney Opton, Environmental Resources Planner

Gentlemen:

We have reviewed the above-noted report and offer the following comments:

1 The alignment of proposed Route 1 is not compatible with Alternates #4 and #5 of the Fairfield Bypass EIS now being prepared by Caltrans (area from Chadbourne Road to Suisun Creek).

2 In reviewing this EIR/EIS with respect to the Route 1 alignment, it seems the extent of disruption to 4.3 miles of bicycle path and linear park has been glossed over. Preliminary planning on this facility began about ten years ago and much time and expense has gone into the planning, right of way purchase and now the construction of Phase I with Phase II construction next year.

Coordination of this planning effort and subsequent funding for right of way and construction has involved the city, state and federal governments, and most importantly, the citizens of the Fairfield area. With completion of Phase II, more than $2 million will have been expended on this facility.

Construction of the aqueduct along Route 1 would seem to cause nearly total destruction of Phase I. This section of the park/path cost about $1.1 million for construction alone. One can envision the public being somewhat upset after waiting ten years for this much heralded facility, then finally getting to enjoy its use, only to see the pipe laying gang move in and start its destruction.

Section 6.1.1.5 of the EIR/EIS (page 134) discusses the mitigation measures of restoring any disrupted segment of the park/path to its preproject condition. This may sound reasonable on paper, but out on the ground this is impossible to achieve. Even with the most dedicated effort, you just cannot "put it back like it was."

Something that is not specifically addressed in the EIR/EIS is the loss of the use of the park/path for a considerable time period during aqueduct construction and subsequent restoration work.

A totally candid approach to addressing the environmental impact of Route 1 aqueduct construction on the linear park would seem to indicate a more direct and thorough analysis. This analysis might have a considerable effect on the final route selection.

3 If any work is performed within the state highway right of way, an encroachment permit will be required. Application for the permit may be obtained at the Department of Transportation Office of the Maintenance Superintendent at 2019 W. Texas Street, P. O. Box 8, Fairfield, CA 94533. We urge the applicant seeking an encroachment permit to address the impacts affecting the state highway. If the applicant does not comply with our concerns, his encroachment permit will be denied.

A minimum of 4 to 6 weeks is required to process the application and issue a permit. Complex projects may require a considerably longer time.

Please send a copy of the final report to John Gagliano, Caltrans, District 10 Office, P. O. Box 2048, Stockton, CA 95201.

Very truly yours,

John Gagliano

JOHN GAGLIANO, P.E.
A-95 Coordinator
(209) 948-7875

STATE OF CALIFORNIA RESOURCES AGENCY — EDMUND G. BROWN JR., GOVERNOR

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD—CENTRAL VALLEY REGION
3201 S STREET
SACRAMENTO, CALIFORNIA 95816
PHONE: (916) 445-0270

17 July 1981

Mr. Barney Opton
Environmental Resources Planner
Corps of Engineers, San Francisco District
211 Main Street
San Francisco, CA 94105

NORTH BAY AQUEDUCT, PHASE II FACILITIES DRAFT ES/EIR, SOLANO COUNTY

1 We have reviewed the draft and note that a recommended best alternative has not yet been selected. You state that the use of Cache Slough or Lindsey Slough sill remains viable alternatives. We agree with your analysis of the relative merits of each source, however, we recommend your timely selection of an alternative so that the City of Vacaville may begin the necessary accomodations.

Gregory H. Walker

GREGORY H. WALKER
Area Engineer
Delta Watershed

GHW:lah

cc: Mr. Wayne MacRostie, DWR, Central District
Solano County Health Department
City of Vacaville

Resources Building
1416 Ninth Street
95814
(916) 445-5656

Department of Conservation
Department of Fish and Game
Department of Forestry
Department of Boating and Waterways
Department of Parks and Recreation
Department of Water Resources

EDMUND G. BROWN JR.
GOVERNOR OF
CALIFORNIA

THE RESOURCES AGENCY OF CALIFORNIA
SACRAMENTO CALIFORNIA

Air Resources Board
California Coastal Commission
California Conservation Corps
Colorado River Board
Energy Resources Conservation and Development Commission
Regional Water Quality Control Boards
San Francisco Bay Conservation and Development Commission
Solid Waste Management Board
State Coastal Conservancy
State Lands Commission
State Reclamation Board
State Water Resources Control Board

Mr. Wayne MacRostie, Chief
Central District
[illegible]
[illegible]
Sacramento, [illegible]

[illegible]

[illegible] letter of August [illegible], the State transmitted comments [illegible] the draft environmental impact statement/environmental impact report, North Bay Aqueduct (Phase II [illegible]).

[illegible] the attached comment from the Department of Parks and Recreation, which was not available for inclusion in [illegible] earlier [illegible]. Although the Department of Parks and Recreation [illegible] in the Department [illegible] January [illegible] to Dick Kretsinger [illegible] a preference for one of the [illegible] forwarding the comment [illegible] information and use.

[illegible] comments concerning this document.

[illegible]

for [illegible]
[illegible] Secretary for Resources

Attachment

cc: Office of Planning and Research
[illegible] Street
Sacramento, CA 95814

Department of Parks and Recreation
[illegible], San Francisco District
(SCH [illegible])

State of California — The Resources Agency of California

Memorandum

Date : August 17, 1981

To : James W. Burns
Project Coordinator
Resources Agency

From : Department of Parks and Recreation

Subject: North Bay Aqueduct, Phase II
Environmental Assessment/Environmental
Impact Report, SCH# 79110117

The position of the Department of Parks and Recreation with regard to this project remains as stated in the letter from then-Director Cahill to Richard Kretsinger dated January 31, 1980.

With respect to the alternative routes #1 and #4, preferred by Department of Water Resources (p. xvi of the summary), the letter stated:

1 "Alternative one is acceptable to this Department without mitigation measures, since it skirts the Jepson Prairie Project

2 "Alternatives four, five and six follow existing roads which have already disturbed the prairie. As with alternative seven, extreme care must be taken to avoid further damage. These alignments would create severe land and resource management problems, since they cut the project in two. Mitigation measures should include burial of the aqueduct as a pipeline, restoration of all disturbed areas, and funding for the purchase of approximately 1,000 acres of first priority land for the Department of Parks and Recreation."

The Department's position is stated accurately on pages 4 and 46 of the report.

The Department requests that it be kept informed about any additional routes or route changes being considered, so that these may be evaluated with respect to Jepson Prairie Project.

James P. Tryner, Chief
Resource Protection Division

State of California — The Resources Agency of California

Memorandum

Date : September 11, 1981

To : Wayne MacRostie, Chief
Central District
Department of Water Resources
P.O. Box 160088
Sacramento, CA 95816

From : [illegible]tment of Parks and Recreation

Subject: Proposed Alternative Route 1
(Modified) for North Bay Aqueduct

1 On August 25, 1981, the Department of Parks and Recreation (DPR) received a letter and map from the Department of Water Resources (DWR) describing a proposed new alignment for the North Bay Aqueduct. Labeled "Route 1 Modified", this new alignment cuts through vernal pools and native grasslands in priority one acquisition lands of DPR's Jepson Prairie project.

The Department of Parks and Recreation believes that the Route 1 Modified alignment would involve new significant environmental impacts not considered in the Draft Environmental Impact Report for the North Bay Aqueduct which has already been circulated for review. For this reason, the Department holds that any consideration of Route 1 Modified by DWR will require an additional environmental impact report or a supplement to the existing draft environmental impact report as required under the California Environmental Quality Act Guidelines (Section 15067 of the California Administrative Code).

If you have any questions regarding the Department's position on this matter, please contact James M. Doyle at (916) 322-2481.

for [illegible]
Maurice Getty, Chief
Resource Protection Division

UNIVERSITY OF CALIFORNIA SYSTEMWIDE ADMINISTRATION

Office of the Vice President [illegible]
Agriculture & University Services

[illegible]

Mr. Wayne MacRostie
Department of Water Resources
Post Office Box 388
Sacramento, California [illegible]

Mr. Barney Opton
Environmental Branch
Corps of Engineers
211 Main Street
San Francisco, California 94105

Dear Messrs MacRostie and Opton:

I am writing in response to the June, 1981, environmental impact report for phase II of the North Bay Aqueduct.

My comments are made in light of the longstanding research and instructional interest of the academic community in what has become known as the Jepson Prairie. Students and faculty, particularly at the University's Davis campus, have made use of the area for decades. Studies involving such subjects as the genetics and pollination biology of native plants, the classification and genesis of the soils, and the invertebrate biology of the large vernal lake [illegible] have been undertaken. Such studies continue today and more are expected to develop as a result of the recent acquisition of the Southern Pacific Land parcel by The Nature Conservancy. The management objectives of the Conservancy will make it easier for more faculty and students to use the area and will facilitate studies over time periods much longer than previously possible. In addition to these special teaching and research opportunities, there are several endangered species and other special biological features that make it an exceptional field study site for the natural sciences.

There is no question as to the biological importance of the Jepson Prairie area
(this is further attested to by the willingness of The Nature Conservancy to
1 commit [illegible] of its acquisition funds in order to make its purchase). I
therefore favor the alignment with the least impact upon the Jepson Prairie
and am pleased to see routes 1 and 4 as the preferred alternatives. Of these
I prefer route 1 because it has the lesser impact of the two.

Mr. Wayne MacRostie
Mr. Barney Opton
August [illegible]

Route 2 would have the greatest impact on the biological and natural history
values of the [illegible] the vernal pool area. Should route 2 be selected because
2 of economic or political considerations, stringent mitigation measures would be
required to protect the ecological integrity of the [illegible] vernal pool area. [illegible]
are mitigation measures that readily come to mind:

1. Additional land should be placed in protected status as a natural reserve in perpetuity either through acquisition of suitably worded conservation easements or through acquisition of fee title. [illegible] protection should be a [illegible] [illegible] construction and should include perimeter fencing. [illegible] easement approach is suggested since it would be less expensive and would permit continuation of existing land-use practices. It appears that existing grazing practices are compatible with the preservation of the vernal pools. [illegible] purchase lease-back for grazing would be another option.

2. There should be strict limitation of [illegible] operation of equipment and [illegible] within the boundaries of the right-of-way.

3. The mitigation lands should be [illegible]

4. A portion of [illegible] should be rehabilitated [illegible] This is important because [illegible] from the seasonally [illegible] riparian area is suited [illegible] of educational experiences [illegible] and research [illegible] not eliminated by [illegible] the [illegible] properly [illegible] the feasibility [illegible] Great [illegible]

[illegible]

[illegible]

[illegible]

OFFICE OF HISTORIC PRESERVATION
[illegible]

[illegible]

[illegible]

RE: [illegible] North Bay Aqueduct (Phase II Facilities)

Dear [illegible]:

[illegible] the provisions of Section 106 of the
[illegible] Preservation Act of 1966 as amended. If the Agency
[illegible] it should submit documentation to this office
[illegible] pursuant to the Advisory Council on Historic
1 [illegible] Protection of Historic and Cultural
[illegible] (36 CFR 800). Compliance with these
[illegible] completed prior to submittal of the Final
[illegible] Report in accordance with the [illegible]
[illegible] provisions of the National Environmental
[illegible].

[illegible], please feel free to contact Michael [illegible],
[illegible] the Office of Historic Preservation by calling
[illegible].

[illegible]

YOLO-SOLANO
AIR POLLUTION CONTROL
DISTRICT

[illegible]

FROM: [illegible] Air Pollution Control District

SUBJECT: Draft Environmental Statement, North Bay Aqueduct (Phase II Facilities) Solano County, California

On page 70, item [illegible] under AIR QUALITY - CURRENT TRENDS:

The statement is made that that portion of Solano County in the Sacramento
Valley Air Basin is also a nonattainment area for [illegible] and oxidants and in
addition is a nonattainment area for suspended particulates. This area is
in the Yolo-Solano Air Pollution Control District and has the following
1 designations: Ozone - nonattainment, [illegible] - unclassified, Primary TSP -
attainment, Secondary TSP - unclassified. The designation for the Federal
Secondary Standard [illegible] the contribution of rural fugitive dust
emissions to the total TSP [illegible] and permits the District to be
treated as an attainment area.

On page [illegible]

It is stated that air [illegible] for the Sacramento Valley Basin has
been written by the Sacramento Regional Area Planning Commission. SRAPC
2 coordinated the plan development; however, each individual APCD develops
its own plan for stationary sources. [illegible] plan for the Yolo-Solano
APCD is incorporated through the District's [illegible] Element and Program [illegible]

[illegible]

3 Reference [illegible]
[illegible]

[illegible]

Commenting Entity: The Resources Agency of California
August 12, 1981

Response 1

The Department of Water Resources, Division of Design and Construction, has done preliminary design work in connection with fish screening facilities at the proposed North Bay Aqueduct intake. While the preliminary screening design was developed for an intake at Cache Slough, the general concepts would apply to the other potential intake locations.

Previous collection efforts by the California Department of Fish and Game had demonstrated the presence of juvenile chinook salmon in the vicinity of the intake. The biological design criteria were selected to protect the young of this species. Similar protection should be afforded the young of other species expected in the area, such as striped bass, when their total length exceeds about 25 millimetres. However, the eggs and larvae of striped bass will not be protected by these design criteria.

To protect juvenile chinook salmon near the intake from being impinged, the maximum approach velocity (flow/screen area) will be held to 0.5 feet per second. To prevent salmon and other fish from being entrained, the maximum screen opening will be 5/32-inch for perforated plate and 3/32-inch for profile wire (also known as welded wedge wire).

Attachment 1 (Figure 1) shows an overall site diagram for the Cache Slough intake. The important item here is that the pumping plant is located in the channel, a location that minimizes the problems of pulling fish into dead-end situations such as increased losses to predators (as might occur when the pumps are located in cuts in the levees).

Attachment 1 (Figure 2) shows how the screens are located in the pumping plant. Each screen is a cylinder constructed of profile wire, with the intake pipe extending about halfway into the cylinder. With a screen design of this type, variation in approach velocity across the screen face is minimized. The cylinder will be constructed of 304 stainless steel to eliminate corrosion.

Screens constructed of profile wire have been shown by Smith (1979) to have cleaning advantages and to clog more slowly than similar screens constructed of perforated plate, even though the perforated plate had openings 1/16-inch larger. In spite of a built-in self-cleaning capability, head loss across the screen face caused by clogging will eventually increase to levels that will make additional cleaning mandatory. There are automated air burst cleaning systems for screens of this type; however, the original screen cleaning system for this intake will consist of a high pressure wash. The screens will be on tracks and will be pulled by crane to a level on the pump station where they can be thoroughly washed. Automatic sensors will warn operators when the screens need cleaning.

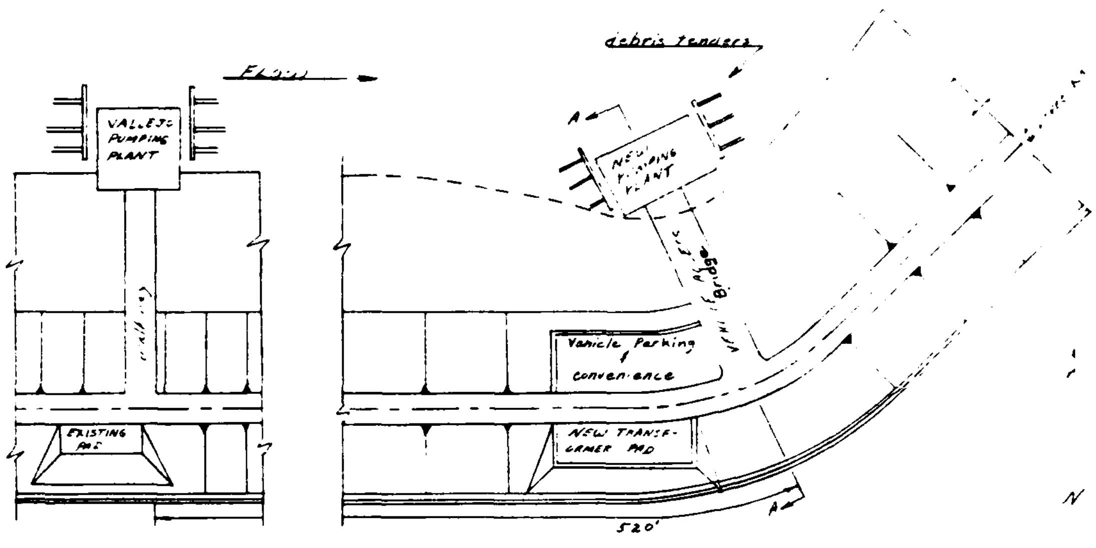
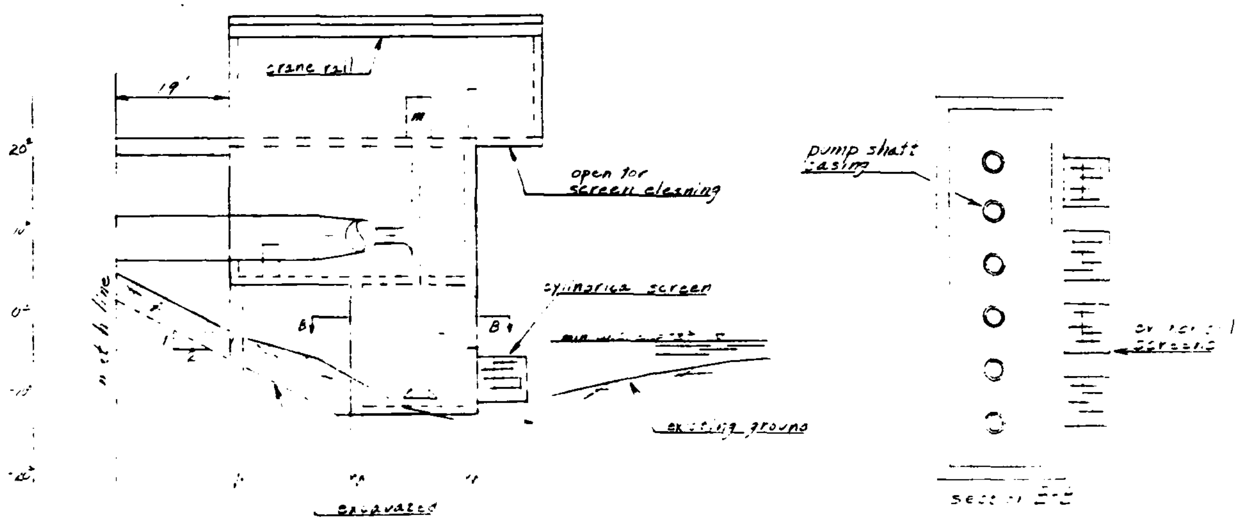


FIGURE 1
POSSIBLE DESIGN OF
CACHE SLOUGH PUMPING PLANT
scale: 1" = 40'

1/3

FIGURE 2
POSSIBLE DESIGN OF
CACHE SLOUGH PUMPING PLANT



Response 2

Details of the daily operational schedule for the North Bay Aqueduct will be determined during the design phase of the system. Estimates of monthly deliveries have been made. Under the maximum annual entitlement of 67,000 acre-feet, the maximum monthly rate will vary from a maximum of 115 cfs to a minimum of 70 cfs. During the entitlement buildup period, these rates will be less. The general estimate of the monthly distribution in terms of percent of maximum annual diversions is:

January	6.1	April	7.3	July	11.0	October	8.4
February	5.2	May	10.6	August	11.0	November	6.3
March	6.3	June	11.0	September	10.4	December	6.4

The negotiations for water conservation programs now in progress are reviewing entitlement delivery schedules. These programs will provide important mitigation for fishery impacts at the North Bay Aqueduct intake. The Department of Water Resources is negotiating reasonable and enforceable conservation programs with North Bay Aqueduct water contractors. This water conservation will extend contract entitlement buildup schedules and delay the need for the maximum annual entitlement delivery. This conservation will delay annual diversion increases and reduce fishery impacts. The Department of Water Resources will investigate other mitigation measures in addition to mitigation from conservation if future studies identify significant fishery impacts at the intake location. The NBA diversion represents only a small percentage of Sacramento River flows. (See Response 6 to National Marine Fisheries comment letter and Section 3, Corrections and Additions to page 146.)

Response 3

The effect of net flow reversal in Cache Slough on the riparian habitat should be negligible because the water velocity changes induced by export pumping will be at least one order of magnitude less than the velocities induced by tidal action. A very weak tidal current of 0.5 knots is equal to about 10 inches per second, whereas the cumulative net flow reversal of Cache Slough with the proposed project (0.014 feet per second) will be less than 0.2 inches per second. The effect of the flow reversal will be a slight reduction of the outflow velocity during ebbing tides and a slightly greater increase of the inflow velocity during flooding tides. The greatest momentary flow increase created by the pumping will be somewhat more than the net flow reversal figure but it should still be considerably less than one inch per second. This still is a negligible increase in terms of potential for damage of the riparian habitat by levee erosion or direct plant damage during higher tides.

Response 4

In planning for the State Water Project, which includes the North Bay Aqueduct, the Department recognizes its responsibilities to prevent water quality degradation and inadequate flow in the Delta as specified by Decision 1485.

The diversions for the North Bay Aqueduct are subject to water quality and water rights decisions made by the State Water Resources Control Board. The Department of Water Resources will investigate other diversion limitations in addition to mitigation from conservation if future studies identify significant fishery impacts. Urban water conservation is a part of the preferred alternative and will extend entitlement buildup schedules, correspondingly delaying annual diversion increases. (See Response 1 to comment letter from U. S. Environmental Protection Agency.)

Response 5

Comment noted. The Department of Water Resources will consult with the Department of Fish and Game during design of the North Bay Aqueduct to determine the feasibility of potential fish and wildlife enhancement measures along Route 1, the preferred aqueduct alignment. Because Route 1 would consist of an underground pipeline, the opportunity for regular releases of fresh water to sloughs or creeks along the alignment will probably be minimal. (See Response 2 to comment letter from National Marine Fisheries.)

Response 6

The possible mitigation measures listed under Section 6.1.1.5.1 and relating to the Route 1 alignment will be incorporated into the planned mitigation category.

Response 7

To insure full consideration of seismic hazards, design of the North Bay Aqueduct and pumping facilities will adhere to the following procedures. Known faults and seismic history (including that related to the Vacaville-Winters-Dixon earthquakes) in the vicinity of the proposed aqueduct alignment will be studied and maximum ground acceleration at various key aqueduct facilities such as pumping plants will be calculated. This information will then be used to calculate anticipated seismic loads. These loads will be compared with those required by Section 2312 of the Uniform Building Code. Design will be based on the most critical loading condition.

Response 8

Comment noted. Subsequent to preparation of the Draft ES/EIR, the Department of Water Resources conducted additional water quality sampling in Cache and Lindsey Sloughs. The findings of this investigation are presented in the report, "Investigation of Cause of Increase in Chloride Concentrations at Proposed North Bay Aqueduct Intake in Cache Slough", prepared by the Central District in July 1981. This report investigated historical water quality for Cache and Lindsey Sloughs, possible sources of chlorides in Cache Slough, and future quality projections for Cache Slough.

The report found that water quality data are available for Cache Slough since the city of Vallejo began diverting in 1953. Weekly chloride date of the

Cache Slough water are available in the Vallejo water treatment plant laboratory records from 1960 through 1965 and from 1970 through 1980. Total dissolved solids (TDS) measurements began in 1975 and are available through 1980. This historical data shows monthly TDS ranges between 150 to 390 mg/L with yearly mean ranges between 191 to 253 mg/L. Historical chloride data were reviewed by comparison to Lindsey Slough.

The report considered DWR Bulletin 65, which contains monthly (single) grab sample data for chlorides and TDS for Lindsey Slough (near Rio Vista) from 1952 through 1965.

A comparison of mean monthly chloride concentrations in Cache and Lindsey Sloughs from 1960 through 1965 shows that Lindsey Slough is substantially lower in chlorides for this period. Lindsey Slough ranged from 5.1 to 37 mg/L, whereas Cache Slough ranged from 10 to 49 mg/L. Perhaps of more significance is a comparison of the mean yearly chloride concentration, with Lindsey Slough having a low of 11.5 and a high of 19.2 mg/L and Cache Slough having a low of 18 and a high of 29 mg/L.

The report also looked at the present Department of Water Resources sampling program. In the fall of 1980, the Department of Water Resources established a one-year water quality sampling program for Cache and Lindsey Sloughs. Monthly samples at the primary station, Lindsey Slough (near Rio Vista) near the confluence with Cache Slough, are analyzed for many parameters. Two secondary stations, Lindsey Slough at Hastings Cut and Cache Slough at the City of Vallejo Pumping Plant, are being sampled monthly for chlorides, total dissolved solids, and electrical conductivity, and less often for other parameters such as manganese and iron. DWR will continue to sample these parameters and to use this information to determine treatment requirements of North Bay Aqueduct supplies.

The report showed that during the past 20 years, there has been a considerable increase of the chloride concentration in Cache Slough at the City of Vallejo Pumping Plant. Three possible sources have been suggested:

- Intrusion of saline waters from the Bay system.
- Chemical applications on crops in the watershed that drains into Cache Slough.
- Sewage generated in the watershed.

A study of Bay-Delta salinity intrusion has helped to determine that the intrusion of saline bay waters is not a likely source of chlorides at the Vallejo pumping plant. Because the junction of Lindsey Slough with Cache Slough is several miles closer to the Sacramento River than the pumping plant, any salinity intrusion from the bay system should affect the lower part of Lindsey Slough as much or more than the sector of Cache Slough near the pumping plant. However, in February 1981, when the chloride concentration at the pumping plant reached 110 mg/L, the concentration in Lindsey Slough near Cache Slough was only 33 mg/L. This suggests that in this particular instance, the high chlorides at the Vallejo pumping plant were not due to intrusion of bay waters. The seasonal pattern of chloride in Cache Slough at the Vallejo pumping plant differs from seasonal patterns of Bay salinity intrusion and this tends to refute the possibility that bay water intrusion is the source.

The report used information from persons familiar with agricultural practices in the Ulatis Creek watershed, which drains to Cache Slough, who were interviewed regarding possible sources of chloride. The interviews indicated that very little chloride was included in the chemicals and fertilizers being applied to crops and soils; therefore, it was not likely that these applications were producing the high chloride levels at the Vallejo pumping plant. It is quite possible, however, that agricultural practices in the watershed are important in determining the seasonal pattern of high chloride levels that occur in Cache Slough.

Since little of the diverted water is wasted, most of the salts dissolved in the water are left in the irrigated soils as evapotranspiration occurs. The excess salts are then leached from the soil by fall and winter rains and are transported to Cache Slough in the resulting runoff. If the irrigation water used by the two irrigation districts were high in chlorides, then the leaching of accumulated salts would explain the high chloride concentration in Cache Slough in the winter.

The report studied two waste treatment plants found to be discharging to streams or lands tributary to Cache Slough:

- The City of Vacaville Easterly Sewage Treatment Plant in Elmira.
- The plant for the industrial complex northeast of Vacaville.

Both plants serve the food-processing industry and these processors may be contributing chlorides to streams in the watershed. Since this study was conducted during the winter, the onion dehydrator in Vacaville was not operating; therefore, no information was obtained about the quantities of chloride that it may contribute. The Elmira plant capacity is being increased, and treatment is being improved. The Elmira plant is treating 19 to 23 megalitres (5 to 6 million gallons) per day, which is about 10 times the normal discharge of the plant at the industrial tract. Because of this difference in quantity of waste water handled by the two plants, study was concentrated on the City of Vacaville Easterly Sewage Treatment Plant. To determine the amount of chloride content in the Vacaville sewage, two work phases were conducted:

- Samples of the influent and the effluent were collected at the sewage treatment plant and analyzed for mineral content.

- An electrical conductivity (EC) recorder was installed to measure EC of the influent.

Using data from the work phases and by evaluating Cache Slough hydraulic conditions, it was determined that the City of Vacaville Easterly Sewage Treatment Plant effluent is probably the cause of the increase in chloride concentration in Cache Slough at the Vallejo pumping plant. However, there must be a loss of chlorides in the basin other than what is pumped by the City of Vallejo. The mean yearly chloride concentration in Lindsey Slough for the 13 years (1953 through 1965) is 14.2 mg/L. Conservatively, the mean annual chloride concentration in Lindsey Slough could now be 20 mg/L. With the assumption that Cache Slough chloride concentration would be similar to Lindsey Slough's if the Easterly Sewage Treatment Plant did not exist, then the mean annual increase in chloride concentration caused by the plant for the years 1974 through 1980 would be about 35.6 mg/L (55.6 mg/L minus 20 mg/L).

These values, as well as historical Cache Slough chloride concentrations, have been within drinking water requirements.

To improve Cache Slough quality in the future, alternative operations for the City of Vacaville effluent discharges were investigated. Under the preferred method of operation, the City of Vacaville would construct 3 miles of pipeline from its present plant and discharge its effluent into Barker Slough drainage. This would be much less expensive than advanced waste treatment of the sewage. However, the chlorides from the effluent would be discharged into Lindsey Slough via Barker Slough, a tributary, and the mean annual chloride concentration in Lindsey Slough would increase considerably with the sewage treatment plant at 30.3 megalitres (8 million gallons) per day capacity. The mean annual chloride concentration in Cache Slough would be in the 20-30 mg/L range. This operation would be a complete reversal of what now exists.

The City of Vacaville is agreeable to this operation and speculation is that the City of Vallejo would be also. The City of Vacaville could get by with the least costly alternative for compliance with Discharge Requirement Order 78-131 and the City of Vallejo would experience a better quality of water, since sewage effluent from the Easterly Sewage Treatment Plant would no longer be discharged into the Cache Slough drainage.

Solano Irrigation District and Maine Prairie Irrigation District presently use the effluent that is discharged into Alamo Creek by the treatment plant. Section 1211, Article 1.5, Chapter 1 of Part 2 of Division 2 of the Water Code states:

> "Prior to making any change in the point of discharge, place of use, or purpose of use of treated waste water, the owner of any waste water treatment plant shall obtain approval of the board for any such change. The board shall review such changes pursuant to provisions of Chapter 10 (commencing with Section 1700) of Part 2 of Division 2."

The "board" is the State Water Resources Control Board, and the City of Vacaville would have to comply with this requirement before changing the point of discharge for the Easterly Sewage Treatment Plant.

Response 9

As indicated in the Draft ES/EIR (page C-19), the general hydraulic characteristics of Lindsey and Cache Slough differ only slightly. Cache Slough, which has a lower water quality than Lindsey Slough, experiences more substantial flood and ebb flows due to greater agricultural and domestic use of slough water, upstream waste water disposal, evaporation, and ground water seepage.

The selection of Route 1 with an intake at Cache Slough as the preferred alignment was based on a number of important factors, including the possibility of joint dredging maintenance and water quality monitoring responsibility with the adjacent City of Vallejo's diversion and the avoidance of a conflict with the City of Vacaville's intention to relocate their upstream waste water disposal to Barker Slough, a tributary to Lindsey Slough. The removal of this waste water discharge from Ulatis Creek will substantially improve water quality in Cache Slough, making it a more logical choice for the North Bay

Aqueduct intake location. (Relationships between the waste water discharge and Cache Slough water quality at the proposed North Bay Aqueduct intake were investigated in a recent DWR study. See Response 8.)

Response 10

Comment noted. Permits required by The Reclamation Board will be obtained before any construction begins.

Response 11

The aqueduct pumping plant and intake structure will not be located in the channel, nor will flows induced by pumping be of sufficient strength to adversely affect navigation and boating safety in Cache Slough. To the extent that dredging of the slough near the intake would be required, the project could benefit navigation in adjacent slough waters. Applicable State and Federal requirements for placement of waterway markers will be satisfied. (See Response 1A to comment letter from U. S. Coast Guard.)

Commenting Entity: California Department of Transportation
August 10, 1981

Response 1

The Department of Water Resources and the Department of Transportation are coordinating planning to avoid conflicts between aqueduct construction and completion of the Fairfield State Highway 12 bypass and Interstate 80 interchange. Representatives of Department of Transportation, the city of Fairfield, and DWR met on January 15, 1982, to review the latest plans for the bypass and interchange. DWR met again with the Department of Transportation on February 4, 1982, to discuss this matter. Some identified alternative locations of the interchange could interfere with a section of the North Bay Aqueduct Route 1 alignment and Phase II of the city of Fairfield's proposed linear park system. If it were necessary to compensate for this interchange, a section of the aqueduct and linear park system alignment along the existing railroad right of way from a location 2,000 feet east of Abernathy Road westerly to Russell Road would have to be moved up to 600 feet in a northerly direction. The aqueduct would require 80 feet of construction right of way through some orchards and vineyards. The permanent right of way will be 40 feet wide. About 370 trees and 800 feet of vineyard would be affected. In addition, the existing right of way for Phase II of Fairfield's linear park system may not be adequate to provide the necessary construction requirement for the North Bay Aqueduct for a distance of about 2,000 feet along the existing railroad right of way, extending westward from Russell Road. If the North Bay Aqueduct construction requires some additional right of way, this could affect about 200 to 400 additional orchard trees.

Response 2

Impacts to the proposed linear park system have been discussed in Section 6.1.1.2 (p. 131) and Section 6.3 (p. 146). The additional impacts provided with this comment letter have been added to the Final ES/EIR. (See Section 3, Corrections and Additions, section 6.1.1.2.) As stated in Section 6.1.1.2.5, Department of Water Resources plans call for mitigation of any adverse effects on the linear park project. The Department will properly restore any disrupted segment of the park and extend the linear park bikeway over some of the railroad right of way segments of Route 1 (Section 6.1.1.5, p. 134). The Department of Water Resources and Fairfield are discussing ways to minimize disruption of the completed linear park segments and to coordinate construction of new segments. The Department will cooperate with the City of Fairfield to eliminate disruption or loss of taxpayers' funds for construction of Phase II of their linear park system.

Response 3

Comments noted. The Department of Water Resources will apply for an encroachment permit with the Department of Transportation. (See also Responses 1 and 2 to comment letter from U. S. Department of Transportation.)

Commenting Entity: California Regional Water Quality Control Board
July 17, 1981

Response 1

As a result of comments received on the Draft ES/EIR and discussions with the local water contractors, the Route 1 alignment with a Cache Slough intake has been selected as the preferred North Bay Aqueduct alignment.

Commenting Entity: California Department of Parks and Recreation
August 17, 1981

Response 1

As a result of comments received on the Draft ES/EIR and discussions with local water agency representatives, Route 1 has been selected as the preferred North Bay Aqueduct alignment.

Response 2

Comments noted. The Department of Water Resources will work closely with the Department of Parks and Recreation during project development and operation.

Commenting Entity: California Department of Parks and Recreation
September 11, 1981

Response 1

Route 1 Modified has been dropped from consideration as a route for the North Bay Aqueduct.

Commenting Entity: University of California
Natural Land and Water Reserves System
August 12, 1981

Response 1

Comments noted. As a result of comments received on the Draft ES/EIR and discussions with local water agency representatives, Route 1 has been selected as the preferred North Bay Aqueduct alignment.

Response 2

The biological sensitivity of areas along the proposed Route 2/2A alignment has been addressed in the Draft ES/EIR (p. 152, Section 6.4.4 and 6.4.6). Stringent mitigation measures such as additional land placed in protected status and fenced, strict limitations on construction, mitigation lands nominated for national landmark status, and a portion of Calhoun Cut rehabilitated as a riparian habitat would be considered if these alternatives were to be constructed.

Commenting Entity: Office of Historic Preservation
September 22, 1981

Response 1

A cultural resources evaluation of the North Bay Aqueduct alignment alternatives, including a field investigation of Routes 1, 4, and 6, was prepared in August 1980 and included in the Draft ES/EIR as Appendix E. In addition, a recent subsurface archaeologic investigation was conducted for site CA-Sol-268 near Cordelia along the Route 1 alignment to determine the significance of the site. The findings of this investigation, developed in consultation with Nick Del Cioppo and discussed with Mike Rondeau, both of the State Historic Preservation Office in Sacramento, are included in Appendix IV of the Final ES/EIR. (See Response 3 to the comment letter from the U. S. Department of the Interior.)

Commenting Entity: Yolo-Solano Air Pollution Control District
August 3, 1981

Response 1

Corrections made. See Section 3.

Response 2

Corrections made. See Section 3.

Response 3

Pacific Gas and Electric Company has postponed indefinitely any development of a power plant at the Collinsville site. No evaluations have been completed to determine the effects of this plant on the aquatic environment. No active planning is being conducted for this plant.

COMMENTS AND RESPONSES

LOCAL AGENCIES

NAPA COUNTY

FLOOD CONTROL AND WATER CONSERVATION DISTRICT

1127 FIRST STREET • NAPA, CALIFORNIA 94558
AREA CODE 707 253-4351

HARRY D. HAMILTON
District Engineer

August 11, 1981

[illegible]

Ladies and Gentlemen:

The purpose of this letter is to offer comments on the Draft Environmental Statement/Environmental Impact Report-North Bay Aqueduct (Phase II Facilities) Solano County, California dated June 1981 and to state the position of the Board of Supervisors of this District on the project.

The main concerns of Napa, and the agencies that subcontract for State Water Project water from us, is sufficient quantity of good quality water at the most reasonable price. Napa must have the North Bay Aqueduct completed in order to meet its water committments to its subcontractors and will insist that DWR meet its commitments to Napa for that water.

Recent meetings with Solano and its subcontractors for State Water Project water indicate that, for a number of reasons, it will be to the advantage of Napa and Solano and their subcontractors for State Water Project water, to mutually support construction of the North Bay Aqueduct, Phase II on alternative alignment Route 1.

1 Napa is willing to join in this support, but with the understanding that, through an arrangement where those contractors benefiting by the Alternate I alignment "make whole" the other contractors, water will be delivered at Cordelia to Napa and Benicia for no more cost than would have been the case if alternate alignment No. 2 had been constructed. The costs assigned to alternate No. 2 are to include environmental mitigation costs which will be negotiated by Napa and Solano and their subcontractors.

We have however, reviewed this ES/EIR and have reached the conclusion that Alternative Alignment Route 2 should be included with Routes 1 and 4 as a "preferred" alternate for the construction of the North Bay Aqueduct, Phase II. This conclusion is based on the following:

A1. Even with mitigation costs (which we disagree with) and secondary construction costs (which are of no benefit to Napa) included, Route 2 is the most economic of all those considered. Without mitigation and secondary costs included, construction costs for Route 1 are over 60%, and for Route 4 over 50%, higher than for Route 2. These costs will be directly reflected in the Capital Cost Component of the Transportation Charge for North Bay Aqueduct water.

A2. Even with secondary power costs (which do not affect Napa) included, annual operation and maintenance, a large part of which is power cost, is lower for Route 2 than for any other route considered. Without secondary power cost included, maintenance and operation for Route 1 is over [illegible] higher, and for Route 4 over 13% higher, than for Route 2. Since conservation is much discussed in that report it appears that this energy conservation should be an important factor. These costs [illegible] Transportation Charge for North Bay [illegible]

A3. Since Routes 2 and 2A are much shorter than any other, it appears that they would have less affect on Jepson Prarie and/or on agricultural land.

A4. Comments at the Public Hearing seemed to indicate more alarm by agriculturists over Route 1 than over Route 2.

A5. Concern over public safety where Route 2 is concerned appears to be unfounded when 16 years of record on the South Bay Aqueduct indicates no drownings.

A6. Even if the entire 60 foot right of way width for the Route 2 canal were considered to be removed from the Jepson Prarie, we are talking about a total of approximately 35 acres compared to a total area designated as Jepson Prarie of some 20,000 acres. An "at least" 3,000 acre purchase of "compensation acreage" stipulated by the State Parks and Recreation Department as mitigation for adverse impacts on the Jepson Prarie by Route 2, is absolutely rediculous, particularly since that Department (See Section 2.2.5.1) has no "permit or regulatory authority over the North Bay Aqueduct project". This requested "mitigation" amounts to almost 100 to 1 protection which is mighty high powered blackmail (See Section 6.4.16).

We now speak specifically to Section 6.5.2 of the report which states in part: "Routes 2 and 2A are not considered further in this report because of the significant implications on the Jepson Prarie (and associated rare and endangered species), conflicts with the designation of Calhoun Cut as a "natural area" in the proposed State Waterways Plan, the extensive amount of dredging required along Calhoun Cut, the need to construct additional access roads and, for Route 2 only, the encroachment of farmland and need to construct an additional pumping plant south of Travis AFB".

B1. We do not believe that "significant implications on the Jepson Prarie (and associated rare and endangered species)" has been shown, in fact Section 6.1.1.1.8 indicates that test borings along Route 2 have indicated that vernal pools would probably not be affected and Section 6.1.1.1.15 indicates that most rare and endangered species are associated with vernal pools.

B2. It seems ludicrous that Calhoun Cut, a man made feature is proposed as a "natural area" in the State Waterway Plan. We would hate to think of the EIR required if such a facility were porposed today. In any event, it appears that any "conflict" with Calhoun Cut being designated a "natural area" would be temporary. Calhoun Cut, by the way, has been the designated location for a North Bay Aqueduct, Phase II Water intake since the early 1960's when Napa and Solano became State Water Project contractors.

B3. Since the cost of dredging and disposal is included in construction cost estimates for Route 2, it seems that it has been taken into account. Land disposal of dredge spoil is common throughout the delta, the State, the Nation and the world and should not be an insurmountable problem whether or not land acquisition for such disposal is necessary.

B4. We are not sure what is meant by "additional access roads" for Routes 2 and 2A, but since they are shorter routes than the others it seems that the reverse may be true. Access roads in agricultural areas are common and [illegible] not create any major problems.

B5. Section 6.1.1.1.4 indicates that the "more significant stretches of prime agricultural soils" are the eastern and western portions of Route 1 and all of the other Routes west of Suisun City, which would indicate that encroachment of farmland by Route 2 would not be in prime agricultural soil.

B6. Since, even with "an additional pumping plant south of Travis", Route 2 uses less energy than any other Route and has a much less maintenance and operation costs and the pumping station would only occupy about an acre of land it does not seem a likely reason for not considering Route 2.

All of the above seems reason enough to include Alternate Route 2, without [illegible], as one of the "preferred" Routes.

Very truly yours,

[illegible], Chairman

Napa County Flood Control and Water Conservation District

JM HDH [illegible]

AMERICAN CANYON COUNTY WATER DISTRICT

August 19, 1981

California Department of Water Resources
Central District, 3251 S Street
Sacramento, California 95816

and

Napa County Flood Control & Water
Conservation District
1195 Third Street, #201
Napa, Calif. 94558

Gentlemen

Subject: Comments on E.I.R. of N.B.A., Phase 2

The American Canyon County Water District is not in opposition to the outcome of a meeting held on August 10 in Fairfield by Solano and Napa Counties' staff with most of the sub-contractors in attendance. At this meeting it was basically agreed that all entities would support alignment No. 1, under the concept that Napa County and its sub-contractors would be held harmless of costs over and above the construction and operation of alignment No. 2

1 However, we share Napa County Flood Control's opinion that mitigation measures requested by the State Parks and Recreation Department are ridiculous and totally unjustifiable. It should be borne in mind that the project is based on the need of the people and not some fancy idea of a special interest group.

Therefore, we are conditioning our support for align. #1 upon an agreement of the following factors:

2 1. That the quantity of our current water rights contract will not be reduced.

3 2. That before a ratio of cost factors between align. #1 and #2 is calculated:

a. only acceptable mitigation measures are included in the cost of align. #2 and

California Dept. of Water Resources ... August 19, 1981
and
N.C. Flood Control District

continued

b. the secondary construction cost, which are of no benefit to Napa, be excluded from the cost of align. #2

Sincerely yours,

Rodolfo Lepoutre

Ralph D. Lepoutre
President

RDL:dm:ah

City of NAPA

1600 FIRST STREET P.O. BOX 660 NAPA CALIFORNIA 94559
TELEPHONE (707) 252-7711

OFFICE OF
PUBLIC WORKS DIRECTOR

August 10, 1981

Mr. Wayne MacRostie
Chief, Central District,
State Department of Water Resources
P.O. Box 160088
Sacramento, CA. 95816

Dear Mr. MacRostie:

Re: North Bay Aqueduct Draft E.S./E.I.R.

I am writing to submit the comments by the City of Napa to the draft E.S./E.I.R. report dated June 1981, for the North Bay Aqueduct Phase II Facilities, distributed with your letter of June 26, 1981. This draft report was considered by the City Council of the City of Napa at their meeting on August 4, 1981, and they authorized the following comments:

1. Aqueduct Size: The City of Napa supports the concept of a combined program of conservation, reclamation and construction of the North Bay Aqueduct, Phase II. The City believes that it will require this combined program to provide for the water needs of our citizens in the future. In particular, however, the City will need all of the water it has contracted and committed for (17,000 acre feet, maximum entitlement) from the North Bay Aqueduct. Combined with the other water users in Napa County that will need N.B.A. water, this equates to the full contract quantity for Napa County, 25,000 acre feet. It is, therefore, requested that the Phase II N.B.A. facilities be sized to provide the full contract quantity, 25,000 acre feet for Napa County users.

2. Time of Completion: As you know, the City of Napa has been receiving virtually a continuous supply of water from Phase I of the N.B.A. since 1968. This has been made possible by an interim arrangement to receive water from Solano County via the Putah South Canal. This water supply from the N.B.A. has become a permanent, essential part of the City of Napa water system, such that the City must have a continuous water supply from the N.B.A. system. Recently the extent of the time that Solano County will be willing to continue the interim supply to Phase I of the N.B.A. has become questionable. They have advised Napa County that Solano's water needs from the Berryessa project are growing and that they need the interim water now being supplied to Napa County. Thus it is extremely important to the City of Napa and other Napa water users that the N.B.A. Phase II facilities be completed at the earliest possible time. The City of Napa requests that the N.B.A. Phase II project be expedited by the Department of Water Resources for delivery of water by 1984 if at all possible.

Mr. Wayne MacRostie
August 10, 1981

Page Two

3. Water Quality: The City of Napa considers the matter of the quality of the water supply to be received from the Delta to be the single most important consideration. While full and complete treatment of all water received will be performed by the City prior to delivery of the water to our consumers, the extent of treatment that can be economically provided is limited. In particular the matter of the total dissolved solids content and the concentration of particular mineral constituents can be critical and seriously affect the end product received by the consumer. At the public hearing held on July 29, 1981, in Fairfield, I received a copy of the DWR report entitled, "Investigation of Cause of Increase in Chloride Concentration at Proposed North Bay Aqueduct Intake in Cache Slough." This report is extremely alarming in its projections of future chloride concentrations at the Cache Slough intake in one instance, or at the Lindsey Slough intake in the other instance. The higher level of concentration projected is unacceptable to the City of Napa. It is absolutely essential that the location of water supply intake(s) and the location of waste treatment facility discharges be coordinated so that the water supply intake for the N.B.A. Phase II receives the best quality water available in this area of the Delta. The City believes that this is the most critical factor involved in this entire matter. We very earnestly request the Department of Water Resources to plan the final intake location decision extremely carefully so as to insure a permanent supply of the highest quality water available for the North Bay Aqueduct.

4. Cost: As the City of Napa is the largest user of N.B.A. water in Napa County we are very concerned about the cost of the N.B.A. Phase II facility. As the full cost of this facility is to be repaid the State by all of the water users, cost is extremely important to all local agencies and their water customers who through their water bills will actually pay for the N.B.A. The D.W.R. is urged to minimize the cost of this facility while insuring good water quality and well constructed, permanent facilities. The annual cost of operation, power requirements and maintenance are equally as important as the cost of construction, and there should be careful planning to insure the lowest possible annual cost situation.

Very truly yours,

John W. Lindblad

John W. Lindblad, P.E.
PUBLIC WORKS DIRECTOR

JWL:kc
cc City Manager
City Clerk
Assistant City Engineer
Mr. Harry Hamilton

CITY OF VALLEJO

31 July 1981

[illegible]

[illegible]
[illegible]
[illegible] Water Resources
[illegible]
[illegible]

Dear Mr. [illegible]:

[illegible] wishes to make known to the Department of Water Resources that Route No. 1 for the Aqueduct is definitely preferred over the other route being considered. We feel that having the intake at Cache is a benefit to our facility at that location for several reasons. The many common maintenance tasks would be jointly handled and be more easily accomplished.

With the intake at Cache, Vacaville would be able to use other outlets than Cache for its sanitary facilities, which has been a worry for both entities.

Sincerely,

ERWIN J. FOLLAND
Water Superintendent

cc: Director of Public Works

COG SAN JOAQUIN COUNTY COUNCIL OF GOVERNMENTS

August 20, 1981

Barney Upton
Environmental Resources Planner
Environmental Branch
U.S. Army Corps of Engineers,
San Francisco District
211 Main Street
San Francisco, CA 94105

Re: Draft Environmental Statement for North Bay Aqueduct Phase II Facilities, Solano County, California, Public Notice 12950-58

Dear Mr. Upton:

Thank you for the opportunity to comment on this draft EIS/EIR.

Our area of concern with this project is its effect on water quality in the Sacramento-San Joaquin Delta specifically the relationship of increased water diversions to salt water intrusion from San Francisco Bay.

1 In Section 6.1.2.3.1 of the draft EIR/EIS it is stated that "The maximum proposed diversion of 115 cfs.... would have no significant effect on net Delta outflow. The water diverted would come from high, excess flows...."

It appears that these proposed facilities could potentially be used to divert water from the Delta during other than excess flow periods. Political pressure for such diversions might arise during periods of widespread water shortage when Delta flows in excess of those needed to repel salt water intrusion do not occur, and water is not available from other sources.

2 We feel that the final EIS/EIR should address the possible effects of diversion of up to 115 cfs by the North Bay Aqueduct during periods of low flows. It should also address safeguards which could be instituted to protect Delta water quality from degradation as a result of this project under all circumstances.

Very truly yours,

GORDON E. MOORE
Planner

GEM/cv

Fairfield Suisun Sewer District

[illegible]

August 21, 1981

Department of Water Resources
Central District
P. O. Box 388
Sacramento, California 95802

Attention: Mr. Ed Whisman

Subject: North Bay Aqueduct Administrative Draft ES/EIR
Phase II Facilities

Gentlemen:

The Fairfield Suisun Sewer District appreciates the opportunity to review the Draft ES/EIR for the North Bay Aqueduct Phase II Facilities. The following comments are presented for your consideration:

Section 3.2.3.1. Water Conservation

1 The District totally disagrees with the assumption that a reasonably intensive promotional campaign will have the same effect as a drought on public acceptance of water conservation devices. The uncertainty associated with the duration of a drought influences substantially the receptiveness of the public toward conservation measures. During the 1976-1977 drought, conservation was the only available solution to an actual water shortage. Limiting the total water supply for Solano and Napa Counties to the existing resources by delaying construction or reducing the size of the North Bay Aqueduct would expose the residents to extreme hardship during a drought year, if the buffer capacity of conservation has been previously exhausted.

2 The proposed conservation plan requires the installation of devices to reduce the volume of water for flushing toilets. Most new homes in the Fairfield-Suisun-Cordelia area have low volume toilets. The old toilets were not designed to operate on low volumes and consequently, reducing the volume will result in repeated flushing and increased water use. Most of the older house laterals were installed on very flat slopes; consequently, plugging of house laterals and smaller collection sewers would increase substantially. In addition, based on past experience, reducing the volume of wastewater will require the Sewer District to hire a three-man crew to flush the sewers during the summer months to prevent health and odor problems. The downtown areas of Fairfield and Suisun City would be the most seriously impacted. The additional water capacity that can be provided by conservation measures should be reserved as a buffer to be utilized in severe drought years.

Reply to:
☒ [illegible]
☐ 1010 [illegible]

Fairfield Suisun Sewer District

Department of Water Resources -2- August 21, 1981

Section 5.3.2.3. Threatened and Endangered Species

3 The results of the survey on threatened and endangered species (Appendix I) should be presented in this section for clarity. In particular the following statements:

"Suitable habitat for the other species of plants is not close enough to the alignments to warrant any special consideration during construction.

Of the animal species, no suitable saltmarsh habitat exists along the alignments for the saltmarsh harvest mouse. Habitat for the delta green ground beetle has been precisely delineated by recent investigation and is not crossed by either alignment. The giant garter snake requires permanent fresh water. The only possible sites satisfying this requirement occurs at the intakes at Lindsey and Cache Sloughs. Unless the construction and operation of the aqueduct affects the perenniality of these water bodies, the habitat would probably not be affected."

4 The recent observation of the black rail should be described in detail. It is our understanding that the observation was an audible one and not an actual sighting. Also, the actual distance the black rail is from any of the NBA alignments should be noted.

Very truly yours,

Ronald A. Tsugita

Ronald A. Tsugita

/kt

cc: Mr. David Balmer, County Administrator
Solano County
Mr. Ben Huber, President
Fairfield-Suisun Sewer District-Board of Directors
Mr. Charles Long, District Financial Manager
Fairfield-Suisun Sewer District Executive Committee

[illegible]

COUNTY ADMINISTRATOR
DAVID BALMER
(707) 429-6211

CLERK OF THE BOARD
JOHN BLACKLOCK
(707) 429-6218

SOLANO COUNTY

August [illegible], 1981

Wayne MacRostie
Chief, [illegible] Division
Department of Water Resources
[illegible]
Sacramento, CA [illegible]

Dear Mr. MacRostie

The Solano County Flood Control and Water Conservation District takes this opportunity to submit comments on the *Draft EIS/EIR for the Phase II* facilities of the North Bay Aqueduct. This response will arrive in your department after the termination date of the State review period, however, it should be well within the Federal review period which terminates August 31, 1981. A copy of this response is simultaneously being submitted to the Corps of Engineers.

1 Page 2, paragraph 1.2.3. The interim supply to Napa County was made available by the Solano County Flood Control and Water Conservation District which agreed to furnish a portion of its water supply, available through the Solano Project facilities originating at Lake Berryessa, to Napa County pending completion of phase II of the North Bay Aqueduct.

2 Page 16, paragraph 3.2.2.2.2. The EIR states, "Groundwater is used primarily during the summer months when water demand is high and surface supplies (i.e. Solano Project) are reduced." This is an incorrect statement. As a matter of fact, surface supplies from the Solano Project are at a maximum in the summer months of June, July and August.

3 Page 17, paragraph 3.2.2.2.3. The last sentence reads, "Although the Putah South Canal apparently has the capacity to accommodate additional water flows, downstream water quality agreement would prohibit the use of the canal for transporting groundwater." The meaning of this sentence is not clear.

4 The report discusses Solano Project reanalysis on page 18, paragraph 3.2.2.3.2. This procedure assumes that you can increase the safe yield of the Solano Project by accepting shortages more frequently in dry periods. The County of Solano will not be willing to reduce its deliveries in its Solano Project supply. This concept should be discarded as unacceptable.

5 [illegible] water conservation program [illegible] several areas [illegible] water use [illegible] accomplished [illegible] to be questionable areas. [illegible] attributed [illegible] be acceptable [illegible] parities [illegible] accomplished [illegible] water saving [illegible]

6 The report points out on page [illegible], paragraph [illegible] that Napa and Solano counties were among the most severely affected [illegible] drought. Most, if not all, of the communities in these counties initiated some sort of conservation program at that time.

7 If the Cities and County should adopt the strictest type of conservation program and thereby decrease the water use and decrease the capacity of the North Bay Aqueduct, the effect of another drought could not be lessened by additional conservation measures, and severe shortages will occur. It would seem that the capacity of the North Bay Aqueduct and the Table A quantities should not be reduced so that a margin of safety exists in the event of future droughts. Furthermore, population estimates are not precise nor are estimates of future rates of water use. Here again, the full capacity and the full Table A quantities should be retained as a guarantee against unanticipated population increases and increases in the rate of water use.

8 There is a considerable discussion of wastewater reclamation as a source of "new water" beginning on page 31, Section [illegible] of the Report. [illegible] some [illegible],000 acre feet of wastewater from the Fairfield-Suisun plant [illegible] by Solano Irrigation District for irrigation of turf crops under an exchange agreement. Additional exchange agreements are possible but the cost is extremely high, therefore, such uses are speculative and should not be considered as firm sources for additional water supplies at this time. [illegible] the contractual commitments for water from the North Bay Aqueduct should not be reduced in anticipation of wastewater reuse that might not materialize. Experience in accomplishing exchanges of water where Solano Project water of relatively high quality would be exchanged for water of inferior quality indicates that such exchanges are difficult, of not impossible, to accomplish.

9 We agree with the statement in paragraph 3.2.3.2.12 on page 34, that says, "However, the study assumes that no additional wastewater reuse will occur by the year 2000 primarily due to the problems discussed above. If an increase

[illegible] the study assumes the full amount will be used to meet agricultural demands expected to develop during the next 20 years. Since these [illegible] demands, the study does not foresee transference of any of the existing agricultural supplies to municipal and industrial use."

10 [illegible] preferred alternative as set forth in paragraph [illegible] on page [illegible] water supply concept of combining water conservation and reclamation with the North Bay Aqueduct and any other supplemental water [illegible] feasible is selected as the preferred alternative [illegible] that the North Bay Aqueduct should [illegible] and the Table A quantities contained in the existing water [illegible], as amended, should be retained.

11 In paragraph [illegible], the report points out that the State Water Project [illegible] does not have conservation facilities adequate to meet the total demands of the project now under contract in that "The State Water Project would not be able to fully deliver entitlement requests *after the early 1980's*." "This inability will be worsened if the NBA is in operation." The Counties of Solano and Napa entered into contracts with the State at about the same time as all the other contractors on the State Water Project. It would appear to be entirely unjustified to consider cutting off the North Bay Aqueduct so that water deliveries made to the Central Valley and to Southern California would [illegible] by an *amount equal to the proposed North Bay Aqueduct* [illegible] a proposal would only tend to worsen the present north/south [illegible] the State Water Project.

12 [illegible] Flood Control and Water Conservation District takes exception to the environmental evaluations relating to the Jepson Prairie and to the mitigation costs assigned to several of the proposed alignments.

13 Paragraph [illegible] Fish and Wildlife Service expresses concern for endangered species associated with the Jepson Prairie vernal pools but nowhere do they [illegible] species would be affected.

14 [illegible] Environmental Protection Agency expresses general [illegible] without specifically [illegible] Jepson Prairie.

15 Paragraph 2.2.3. California Department of Fish and Game expresses concerns with stream crossings and fish screens at the intake but makes no mention of adverse impacts on wildlife in the Jepson Prairie.

16 Paragraph 2.2.5. California State Parks and Recreation does not have any permit or regulatory authority over the North Bay Aqueduct project, however this Department has notified Department of Water Resources that part of the Jepson Prairie is included in its future acquisition program. We question the credibility of this statement and the rationale that attempts to justify the purchase of this type of land for the State Park System.

17 Paragraph 6.[illegible]. The State Parks and Recreation Department has stipulated that compensation acreage of at least [illegible] acres of the surrounding Jepson Prairie would have to be purchased by the Department of Water Resources if the aqueduct were to be built [illegible] alignments [illegible] and 2A. Yet there is no evidence offered that laying an underground pipeline across the prairie and restoring the surface area is any more damaging to the prairie, or even as damaging, than laying the pipeline across [illegible] cultivated cropland. [illegible] estimated [illegible] of the Prairie is between [illegible] actual replacement ratio [illegible].

The information contained in paragraph [illegible] of the EIR is based on "Geologic Appraisal of Vernal Pool" prepared for the Department of Water Resources by Robert [illegible] in 197[illegible].

18 *Although none of the alignments would directly pass through any vernal pools, it has been suggested that aqueduct construction could indirectly disrupt vernal pool hydrology by altering the underlying soil strata. Recent test borings taken along route 2 have indicated that because of the apparent location, depth, and impermeability of underlying clay layers in this area, construction of the aqueduct would probably not affect surrounding pools.*

Since none of the alignments would directly pass through any vernal pools, and the impermeability of the clay layers would prevent any harmful effects to surrounding pools, there is no requirement for mitigation.

19 The entire sum of the stated mitigation costs (3,000 acres at $1,150 per acre equals $3,450,000) is predicated on the unsubstantiated, arbitrary assumptions of Parks and Recreation Department. We consider them to be invalid until the requirements for mitigation and realistic cost assignments can be established on some basis in fact.

20 The District conceptually endorses the Route 1 alignment shown in the EIR. However, the original Route 1, which was initially proposed by this District would be more favored since it would be less damaging to developed croplands. The original Route 1 would follow the Vallejo pipeline from Cache Slough along the outside south toe of the Sacramento-San Joaquin Reclamation District levee to a point of intersection with the Sacramento-Northern Railroad, then follow the railroad right-of-way westerly. While this Modified Route 1 alignment extends through the designated Jepson Prairie it would follow an already existing corridor composed of the railroad right-of-way and the Vallejo Cache Slough waterline. Mitigation costs should be minimal and severance damages

Wayne MacRostie
North Bay Aqueduct

August 20, 1981
Page five

for right-of-way acquisition through developed cropland would be substantially reduced. We request that this Modified Route 1 alignment be reviewed for consideration in the final EIS/EIR. We further request that this project be expedited to the fullest extent possible in order to realize the aqueduct operational forecast date of 1984.

Very truly yours,

Richard Brann

RICHARD BRANN, Chairman
Solano County Board
of Supervisors

RB:cm

cc: Environmental Branch
Corps of Engineers
San Francisco District
211 Main Street
San Francisco, CA 94105

Senator Jim Nielsen
1700 Second Street
Napa, CA 94558

Assemblyman Thomas M. Hannigan
1000 Webster Street
Fairfield, CA 94533

CITY OF VACAVILLE

650 MERCHANT STREET
VACAVILLE CALIFORNIA 95688

August 11, 1981

[illegible]
Director of Public Works

Mr. Wayne MacRostie
Chief of Central District
3251 "S" Street
P.O. Box 160088
Sacramento, CA 95816

Subject: North Bay Aqueduct Draft EIS/EIR

Gentlemen:

The City of Vacaville once again desires to go on record as favoring Route [illegible] as the alignment for the North Bay Aqueduct.

The northerly route has a number of substantial advantages. These include:

1. An ability to use City of Vacaville wastewater treatment plant effluent for reclamation purposes thereby providing an increased agricultural benefit;

2. An elimination of a need to build, operate and maintain an advanced waste-water treatment plant which would continue to dispose of effluent into Alamo Creek;

3. Reduced supplemental pipeline and pump station costs for Vacaville, Fairfield, and Suisun;

4. Improved maintenance conditions at the City of Vallejo's intake at [illegible] Slough; and

5. A reduction of chloride concentrations in the City of Vallejo's water supply.

This route benefits all cities equally. Why should Vacaville have the trans-mission facilities placed in a location which requires them to build larger additional facilities to be able to use the aqueducts water, and which probably would not be a part of the project for funding and construction.

If we may provide you with any further information, please contact me or my staff at (707) 446-6735.

Respectfully,

Mike Baird

for JOSEPH A. MUNOZ, JR.
Director of Public Works

JAM:cb

CITY of FAIRFIELD

Incorporated December 12, 1903

City Hall
1000 Webster Street
Fairfield, Calif. 94533
(707) 425-[illegible]

[illegible] Environmental Affairs

July 29, 1981

Mr. Wayne MacRostie
Chief of Central District
3251 "S" Street
Sacramento, CA 95816

Dear Mr. MacRostie:

We have reviewed the Draft Environmental Statement/Environmental Impact Report for the proposed North Bay Aqueduct (Phase II Facilities). While the document is generally acceptable, it does not fully address the effect of the pipeline alignment on planned developments within the Cordelia area. These developments lie between Suisun Valley Road and Highway 12, north of I-80. It appears that the alignment may disrupt
1 future development, some of which has received approval from the City of Fairfield. To minimize disruption, one of two alternatives should be followed:

(a) Locate pipeline within arterial streets. An arterial street is planned which would connect Suisun Valley Road with Highway 12.

(b) Locate pipeline in areas designated for long-term open space use and/or along existing property lines. In this alternative, the alignment would parallel the Putah South Canal (between Suisun Valley Road and Green Valley Road), then parallel the syphon along its northerly boundary.

The City fully supports the North Bay Aqueduct project, but wishes to reduce its effect on planned developments.

Very truly yours,

Bill Daugherty

BILL DAUGHERTY
Director, Environmental Affairs

BD:RR:lsc

CITY of FAIRFIELD

Public Works

August 4, 1981

Mr. Wayne MacRostie
P.O. Box 60008
Sacramento, CA 95816

Subject: Draft ES/EIR for the North Bay Acqueduct

Dear Mr. MacRostie:

I have reviewed the Draft ES/EIR for the North Bay Aqueduct, dated June, 1981. Although the document was delayed, I feel the Department has done a good job in presenting the project and its impacts.

Although the City of Fairfield does not dispute the concepts of conservation as outlined in the report, we feel that is is not germaine to the issue. The North Bay Acqueduct Contract between the State and Solano and Napa Counties calls for delivery and payment for 67,000 AF/year of water. Of this, Fairfield is entitled to 11,800 AF/year. If we choose to extend this entitlement by promoting conservation, that is
1 Fairfield's option and in no way abrogates the States responsibility to live up to its contract. We, in fact, feel that diminishing out water entitlements by enforcing conservation would be unconscionably poor planning and would be selling future generations down the river. If there is a shortfall of water to meet State contracts, all citizens, statewide, should be effected equally and not those under one particular contract.

Thank you for the opportunity to review and comment on this document. I strongly urge rapid processing and early construction.

Very truly yours,

Joseph L. Shilts

JOSEPH L. SHILTS,
Director of Public Works

JLS:amd

Commenting Entity: Napa County Flood Control and
Water Conservation District
August 1981

Response 1

Although the Department of Water Resources is willing to assist in any way possible during negotiations on cost allocations between the prime water contractors in Solano and Napa counties, it will be the sole responsibility of those water contractors to reach an agreement on an equitable internal allocation of North Bay Aqueduct costs.

Response A1

Comments noted. This information was considered in the planning process. Other information presented in this Final ES/EIR, in connection with environmental impacts, was used to select Route 1 as the preferred alternative along with reasonable and enforceable water conservation programs. Insufficient information is contained in this comment letter to change this determination.

Response A2

Comments noted. (See Response A1.)

Response A3

Because the Jepson Prairie near the proposed intake for Routes 2/2A is closer to a natural state than other potential aqueduct locations, these alternative alignments have the greatest potential for disturbance to the prairie (Draft ES/EIR, Section 6.4.4., p. 152). Although all of the alignments traverse portions of prime agricultural land, Routes 2 and 6 would have the most significant and long-term impact on farmland due to the permanent easement requirements of the open canal segment (Draft ES/EIR, Section 6.4.9, p. 153).

Response A4

Comments noted.

Response A5

It is true that no drownings have been reported in the South Bay Aqueduct, but drownings have been recorded in many other California open aqueduct systems (Draft ES/EIR, Table 5-2, p. 81).

Response A6

Comments noted. In a letter dated August 17, 1981, the State Department of Parks and Recreation reiterated its position with respect to alternative alignments 1, 4, 5, and 6 (see page 101).

Response B1

The Jepson Prairie, particularly the Nature Conservancy's 1,600-acre Jepson Prairie Preserve, is an important plant and wildlife refuge (pp. 64-66). The federally designated critical habitat for the endangered Delta green ground beetle lies immediately to the north of Calhoun Cut. Recent information on this species indicates that its habitat is not limited to areas surrounding vernal pools; it can also inhabit cracks in generally moist soil (Alan Hardy, California Department of Agriculture, personal communication). Two rare plant species were found in the general vicinity of proposed Route 2/2A (Appendix D) and, more recently, a colony of another rare and endangered species was discovered in the area (letter of July 24, 1981, from The Nature Conservancy). This population could be affected by deepening and widening Calhoun Cut as required by proposed Routes 2/2A. Although test borings have indicated that vernal pools along a section of Route 2 would probably not be affected by project construction, continued monitoring of ground water levels in vernal pool areas would be necessary to insure that these habitats would not be adversely affected by a Route 2/2A alignment. Field surveys of the Route 2/2A alignments indicated that the alignment would not pass directly through any vernal pools, although several pools are close by. A concern for indirect effects on vernal pool hydrology is related to the possibility of puncturing underlying clay layers. (See Section 6.1.1.5.1 of the Draft ES/EIR.)

Response B2

Since it was created, Calhoun Cut has been colonized by typical riparian and wetland vegetation and provides important habitat for fish and wildlife. For this reason, it has been designated a natural area in the State Waterways Use Program. Construction of intake pumping plants and fish screening structures, with associated dredging activities to clear intake structures, would have both long-term and short-term impacts on existing habitats. (See p. 129 of the Draft ES/EIR, Sections 6.1.1.1.10 and 6.1.1.1.12.)

Response B3

While construction cost estimates for Route 2 do include costs of initial dredging, they do not include costs of long-term maintenance dredging or disposal of dredged material (footnote d/, p. 48).

Response B4

Although the intake locations on Cache and Lindsey Sloughs are already accessible by existing roadways, additional construction and maintenance roads would have to be built to allow access to the pumping plant and intake structures at Calhoun Cut for Routes 2/2A (Draft ES/EIR, p. 46). These roads would have significant impacts on sensitive areas of Jepson Prairie. Access along Routes 4, 5, and 6 would be provided by Creed Road. (See p. 151 of the Draft ES/EIR, Section 6.4.4.)

Response B5

Comment noted. This is correct. Encroachment of farmland in Jepson Prairie by Route 2 would not be in prime agricultural soils.

Response B6

Comment noted. Route 2 is the least energy-consumptive alternative alignment with respect to pumping requirements. Energy use, maintenance and operation costs, and land requirements are three of numerous impacts and constraints considered in the alternative alignment analysis. (See Table 6-3 of the Draft ES/EIR, pp. 147-151.)

Commenting Entity: American Canyon Water District
August 19, 1981

Response 1

Comment expressing concern for California Department of Parks and Recreation mitigation request is acknowledged.

Response 2

The proposal is for the aqueduct to be constructed to its full design capacity of 115 cubic feet per second to insure fulfillment of current water contract amounts. The preferred alternative includes reasonable and enforceable water conservation programs, which will allow the maximum annual North Bay Aqueduct entitlements to extend further into the future. No reduction of this maximum entitlement will occur.

Response 3

Although the Department of Water Resources would assist in any way possible, it will be the responsibility of the local water contractors to negotiate an equitable internal allocation of aqueduct costs. The Department of Water

Resources has not attempted to refine or narrow the original mitigation measures or costs acceptable to the Parks and Recreation Department for Alignment 2.

Commenting Entity: City of Napa
August 10, 1981

Response 1

Comment noted. The proposal is for the aqueduct to be constructed to its full design capacity of 115 cubic feet per second.

Response 2

The construction schedule calls for completion of the aqueduct system in 1986. This is the earliest date DWR believes feasible.

Response 3

The findings of the report, "Investigation of Cause of Increase in Chloride Concentration at Proposed North Bay Aqueduct Intake in Cache Slough", were that the high chloride concentrations in Cache Slough were primarily due to discharges from the City of Vacaville Easterly Sewage Treatment Plant. The City of Vacaville has been considering relocation of the waste water discharge to Barker Slough, a tributary of Lindsey Slough, in the near future (see comment letter from City of Vacaville, August 11, 1981). Prior to formally pursuing the waste water discharge relocation, the city has been awaiting a decision on the location of the North Bay Aqueduct intake. Once the relocation of the primary cause has occurred, chloride concentrations in Cache Slough will begin to decline. (See also Response 8 to comment letter from The Resources Agency of California.)

Response 4

Comment expressing concern for North Bay Aqueduct costs is acknowledged.

Commenting Entity: City of Vallejo
July 31, 1981

Response 1

Comments noted. Benefits associated with the proposed Cache Slough intake have been documented in the Draft ES/EIR. Route 1 is proposed.

Commenting Entity: San Joaquin County Council of Governments
August 20, 1981

Response 1

Section 6.1.2.3.1 of the Draft ES/EIR has been corrected to state that diversions to the North Bay Aqueduct will be made throughout the year. (See Section 3.)

Response 2

The computer analysis of the proposed North Bay Aqueduct diversion was conducted assuming low-flow, summertime hydrologic conditions (see Appendix F of Draft ES/EIR). The 1976-77 drought period was employed as the data base for establishing these low-flow conditions. These studies showed that the North Bay Aqueduct would have no significant effect on net Delta outflow. In Bulletin 76 the Department of Water Resources presented a plan for protecting the Sacramento-San Joaquin Delta and meeting the water export needs of the SWP and CVP through the year 2000. This plan shows that when North Bay Aqueduct diversions are made during periods of controlled flow, equivalent replacement flows are provided from project storage to maintain required Delta protective outflows. Controlled flow conditions are when Delta protective outflow requirements are being met by project releases. During periods of uncontrolled flows, the North Bay Aqueduct diversions will come from flows that exceed Delta outflow requirements and the diversion will be a small percentage of this outflow. (Also see Response 1 to comment letter from the U. S. Environmental Protection Agency.)

Commenting Entity: Fairfield Suisun Sewer District
August 21, 1981

Response 1

Comment noted. (See Section 1, under Urban Water Conservation and Supplemental M&I Needs.) The preferred alternative does not include delay of construction or reduction of aqueduct size. The preferred alternative consists of the North Bay Aqueduct, sized for full contractual commitments, plus reasonable and enforceable conservation programs for Solano and Napa counties. These conservation programs will enable existing contracted entitlements to extend further into the future. The North Bay Aqueduct is part of the State Water Project, which has reservoir storage designed to provide water supplies during dry periods.

Response 2

Comment noted. Draft urban water conservation plans have been developed for Solano and Napa counties as part of the Final ES/EIR. Each plan is being reviewed with each local agency and tailored to its situation and needs. The information presented in this letter is part of the review process.

Response 3

The cited statements refer to an investigation of the Route 1 and 4 alignments conducted in spring 1980. Although most of this information is incorporated into Section 5.3.2.3 of the Draft ES/EIR, a change is necessary with respect to habitat of the federally protected Delta green ground beetle. Information received since issuance of the draft report reveals that the habitat of the beetle may not be restricted to vernal pools but could also include moist cracks in the earth, which are numerous in Jepson Prairie.

Response 4

The black rail is an extremely secretive bird and most "sightings" of this species are, in fact, audible records. Audible records are widely acknowledged among ornithologists to be fully qualified sightings. The most recent records of bird sightings in Suisun Marsh indicate an increasing number of black rails there.

Commenting Entity: Solano County Board of Supervisors August 20, 1981

Response 1

Correction noted. See Section 3.

Response 2

Correction noted. See Section 3.

Response 3

The city of Fairfield, which draws on water from the Putah South Canal for M&I use, has an agreement with the Anheuser-Busch Company that sets minimum water quality standards for water used at the brewery. Use of the canal to transport ground water from northeastern Solano County would prevent the city from meeting these standards.

Response 4

Comment noted. (See Section 1, under Solano Project Reanalysis.)

Response 5

The draft urban water conservation plans for Solano and Napa counties are being developed by DWR in consultation with representatives of all water contracting agencies and will be tailored to each local situation. The information presented in this comment letter will also be considered in the development of the plans. (See Section 1, under Urban Water Conservation and Supplemental M&I Needs.)

Response 6

Comment noted.

Response 7

Comment noted. The preferred alternative has the aqueduct designed to its full contractual capacity plus implementation of reasonable and enforceable urban water conservation programs. This would enable Solano County to stretch water supplies beyond existing contracted entitlement schedules. Water shortages will not be induced by this preferred alternative. The North Bay Aqueduct is a part of the State Water Project system, which has reservoir storage designed to provide water supplies during dry periods.

Response 8

Comment noted. (See Section 1, under Waste Water Reclamation, and Response 7 above.)

Response 9

Comment noted. (See Section 1, under Waste Water Reclamation.)

Response 10

Comment noted. (See Response 7.)

Response 11

In the event of an extended dry period in which the State Water Project would be unable to fully deliver entitlement requests, all contract users, north and south, would share deficiencies proportionally. To fully meet its delivery schedules in the future, the State Water Project will have to add new facilities to increase project yield. Many of these new facilities are provided for by Senate Bill 200, signed by the Governor and awaiting voter approval.

Response 12

Comment noted.

Response 13

In accordance with consultation procedures of the Endangered Species Act (as amended, Section 7), the U. S. Army Corps of Engineers requested and the U. S. Fish and Wildlife Service provided a list of threatened and endangered species that might be affected by the North Bay Aqueduct project. This list was the basis for field surveys to investigate the presence of endangered species along the alternative aqueduct alignments. The U. S. Fish and Wildlife Service is concerned not only with the direct impacts of aqueduct construction on threatened or endangered species but also more indirect effects on nearby areas due to changes in ground water hydrology (e.g., puncturing the clay pan layer underlying the vernal pools).

Response 14

Comment noted. Environmental Protection Agency concerns would also be extended into distinctive ecological communities (vernal pools) and threatened or endangered species.

Response 15

Comment noted. California Department of Fish and Game concerns would also include specific protection of Jepson Prairie habitats.

Response 16

The Department of Water Resources and the Department of Parks and Recreation, as part of The Resources Agency of California, have a mutual obligation to cooperate wherever possible in matters affecting the natural resources of the State. In the event a Route 2/2A alignment were selected, the Department of Water Resources would require detailed supporting information for the Department of Parks and Recreation's mitigation request. The Jepson Prairie is a distinctive ecological community containing habitats and species found nowhere else in the State. As such, the Department of Parks and Recreation has been interested for a number of years in establishing an ecological reserve in the area.

Response 17

Previous field surveys of the Route 2/2A alignment indicated that the alignment would not pass directly through any vernal pools, although several pools were close by. Two rare plant species were found in the general vicinity of the alignment and, more recently, a colony of another endangered species has been discovered (letter of July 24, 1981, from The Nature Conservancy). Because the Jepson Prairie near this alignment is in a more natural state than other potential aqueduct locations, the Route 2/2A alignment would have the greatest potential for indirect disturbance to vernal pools due to changes in the subsurface soil strata. Although test geologic borings taken along the Route 2 alignment indicated that vernal pools in the vicinity would likely not be affected, characteristics of the subsurface geology in the area are not fully understood. (Also see Response 16.)

Response 18

The concern for indirect effects on vernal pool hydrology was related to the possibility of puncturing underlying clay layers.

Response 19

Comment noted. In the event a Route 2/2A alignment were selected, DWR would discuss mitigation details with the Department of Parks and Recreation. (See Response 16.)

Response 20

With the concurrence of the Solano County Flood Control and Water Conservation District, the modified Route 1 alignment has been dropped from consideration.

Commenting Entity: City of Vacaville
August 11, 1981

Response 1

Comments noted. Benefits associated with proposed Route 1 have been documented in the ES/EIR. (See also Response 1 to comment letter from Napa County Flood Control and Water Conservation District.)

Commenting Entity: City of Fairfield, Office of Public Works
August 4, 1981

Response 1

The proposed project has the North Bay Aqueduct constructed at its full design capacity and maximum annual entitlements under the water supply contracts will not be reduced. Inclusion of reasonable and enforceable conservation programs, as reflected in the preferred alternative with the North Bay Aqueduct, will extend the period water supplies from the aqueduct will be sufficient to meet supplemental water demands.

Commenting Entity: City of Fairfield
Office of Environmental Affairs
July 29, 1981

Response 1

The Department of Water Resources will make every attempt to reduce conflicts arising from the North Bay Aqueduct Route 1 alignment and planned developments in the Cordelia area of Fairfield. Design personnel from DWR have already held preliminary meetings with city of Fairfield staff and representatives of development interests to discuss possible measures to reduce potential disruption.

COMMENTS AND RESPONSES

PRIVATE ENTITIES, ENVIRONMENTAL ORGANIZATIONS, AND THE GENERAL PUBLIC

E N V I R O N M E N T A L D E F E N S E F U N D

North Bay Aqueduct Draft Environmental Statement/
Environmental Impact Report (June, 1981) --

Comments by the Environmental Defense Fund
August 6, 1981

The Environmental Defense Fund (EDF) finds the draft ES/EIR on the North Bay Aqueduct to be severely inadequate with regard to its analysis of alternative sources of water supply for Napa and Solano Counties. The following remarks focus on EDF's reasons for this conclusion, together with suggestions as to how an analysis of alternative sources would be properly done.

Groundwater

The ES/EIR ("the report") discusses other surface and ground water sources for Napa and Solano Counties in §3.2.2. Ground water supply development in Solano County (§3.2.2.1) is asserted to be limited to "at best" 16,000 AF/year. Underlying this
estimate are numbers for past pumpage rates and safe ground
1 water supplies. The estimate of past pumpage rates (143,000 AF/year) is based on the 1963-75 record, and provides no discussion or reference as to how this estimate was obtained. If it is a statistical estimate based on sample data, then this should be stated and statistical variation or standard deviation data

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provided. Is 143,000 AF an upper bound on pumping, a mean value, or what? Although the report is very vague on this point it appears that the majority of this pumpage is for agricultural purposes. Elsewhere in the report, the prospects for new supply from agricultural water conservation are dismissed due to the lack of and cost of transfer facilities to urban use areas
2 (§3.2.3.1 17-18). Yet agricultural water conservation savings would decrease pumpage rates, thereby increasing the supply of groundwater available for other uses. These considerations lead to the conclusion that the 143,000 AF figure, and the implied 16,000 AF extra supply figure, are in large part unfounded and probably result in underestimation of extra supplies available from the ground in Solano County.

Similarly, the report cites recent estimates of "safe supply" of groundwater of from 10[illegible],000-159,000 AF/year. No
3 definition of "safe supply" is provided. Is this the same as "safe yield" as is traditionally defined? The two numbers cited in this range are from two different reports and represent a substantial range of variation. Yet the report uses the difference between 143,000 AF and 159,000 AF (16,000 AF) as the upper limit on new supply from the ground. How statistically valid is this
4 number? The 159,000 AF number obviously has statistical uncertainty, as does the 143,000 AF number. What is the combined, implied variation or standard deviation associated with the 16,000 AF number? It may well be that the 16,000 AF estimate could be

much higher when such variation is taken into account. The report gives no information on this, and it is therefore impossible to evaluate the validity of this number.

The costs of new supplies from groundwater in Solano County are not provided, so that no meaningful economic comparisons to supply increments from the North Bay Aqueduct are possible. A pumping cost is provided, but no costs on distribution
5 of pumped water to new users is given (§3.2.2.2.4-5). It is simply asserted that these costs "could be so high as to make such a plan economically infeasible" (p.17). Such assertions provide no credible basis for comparing the economics of groundwater use to those of the Aqueduct.

Further, no analysis of the effects of reduced pumping due
6 to conservation in various areas on the available safe yield in other areas is performed, technically or economically.

Finally, the report cites the private control of groundwater as a barrier to the implementation of a conjunctive use plan (p.17). This is obviously a red herring, since the
7 agencies sponsoring the Aqueduct have the power and indeed the duty to place preconditions, such as conjunctive groundwater planning, on the receipt of Aqueduct water.

In conclusion, the magnitude and relative cost of the groundwater potential in Solano County have not been credibly
8 analyzed. It is not possible to conclude, based on the report's discussion, the degree or feasibility of groundwater as an

alternative supply source to the Aqueduct in Solano County.

The analysis of the groundwater source in Napa County suffers from the same shortcomings as those outlined above.
9 The estimate range of safe yield is even greater (5,500-25,150 AF) (§3.2.2.7), and the pumpage rate and cost estimates have the same uncertainties as those discussed above for Solano County. The report admits that "As in Solano County, knowledge of Napa County ground water conditions is incomplete" (§3.2.2.8). It asserts that collection and distribution of groundwater savings in agriculture to M&I use would be "considerable" (§3.2.2.8). Yet it offers the solid conclusion that groundwater in Napa County will continue to be used as a local "supplemental" source, and implies that no substitution for Aqueduct water is possible.

This discussion of Napa County groundwater is totally
10 inadequate. It is not possible to evaluate the groundwater option as an alternative to the Aqueduct for Napa County based on the report.

In conclusion, the report provides no credible basis for evaluation of the groundwater option as a total or partial substitute for Aqueduct supplies. Yet the report, which admits
11 the inadequacy of information on groundwater, proceeds to dismiss the viability of the groundwater option (§3.2.4.5). This is tantamount to dismissing the Aqueduct alternative on the grounds that necessary engineering and financial data are not available

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It is impossible to propose and evaluate water supply projects of any sort without performing the necessary studies and data collection. The groundwater alternative has been dismissed merely by choosing not to study and collect information about it. This is obviously an inadequate procedure for evaluating the merits of the Aqueduct.

<u>Urban Water Conservation</u>

The discussion of urban water conservation concentrates entirely upon a small subset of the total possibilities within
12 the urban sector. Distribution and installation of water-conservation devices, landscaping, leak detection, and pressure regulation are important measures which are discussed, but certainly the total potential goes far beyond these measures.

A number of other measures are mentioned (§ 3.2.3.1.21) but dismissed due to lack of technical and economic data. Likewise, the significant conservation potential in the industrial and commercial sectors is dismissed due to lack of information. The report even acknowledges the important conservation potentials in these sectors (§ 3.2.3.1.3): "The conservation potential of
13 the relatively high water use commercial and industrial sector is not discussed in this plan. While the conservation potentials within this sector might be significant, more research would be necessary to quantify any possible water savings." As was already noted above for the groundwater option, these urban conservation potentials are being dismissed as a result of ignorance and not

of analysis which compares them technically and economically with the Aqueduct option.

Another important area for water conservation potential is in the use of water price or rate revisions. Water rates provide users with an economic incentive to conserve. Water rates based on the total costs of supply do not exist in the proposed service areas for the Aqueduct. Various estimates of the price elasticity of demand by urban water users have been made in California, and they tend to vary from -0.5 to -2.00, depending upon which of the residential, municipal, commercial, or industrial sub-sectors are
14 being discussed. The use of water rate revisions through cost-based pricing and/or rate structure revisions have great potential to reduce demand, and thereby conserve water. Such revisions are neither mentioned nor analyzed in the report.

In sum, only a small fraction of the total potential of the urban water conservation option is discussed in the report. Con-
15 sequently, it is not possible to conclude how much of the Aqueduct's capacity can be substituted for with supplies gained through urban conservation.

<u>Agricultural Water Conservation</u>

The report provides a conceptual outline of some of the conservation measures possible in off-and on-farm water use efficiency (§ 3.2.3.1.22 - 26), but no valid estimates of the total savings
16 potential are provided. Indeed, the summary table (Table 3-10, p. 32) of conservation potentials includes <u>no</u> potential in agriculture.

The report attempts to equate the total savings potential from irrigation efficiency to the amount of field run-off that is not

presently reused (§ 3.2.3.1.27). But reusable runoff is not the only loss from irrigation that is a candidate for recovery through agricultural water conservation. Evapo-transpiration losses (ET) can be reduced in several ways. Transpiration can be reduced through crop switching and introduction of more water-efficient cultivars. Evaporation can be reduced through changes in irrigation methods
17 away from the highly evaporative flood & furrow techniques.

Irrecoverable losses also occur through percolation into perched water tables and polluted aquifers. These losses can also be reduced through more efficient irrigation which results in lowered amounts of such percolation.

Finally, water savings can be obtained through more efficient irrigation simply because less pollution of surface run-off and groundwater results. These savings accrue as a result of a reduced need to dilute in order to improve water quality.

No incentives to conserve water in agriculture are mentioned. No price or rate revisions are contemplated. The report has provided neither a technical estimate of the conservation potential in agriculture nor an economic comparison of implementation of such potentials with the Aqueduct option.

<u>Waste Water Reclamation</u>

Waste water reclamation is discussed in some detail (§ 3.2.3.2) and is virtually dismissed as even a partial option to the Aqueduct option. While it notes that there will be 23,000 - 30,000 AF/year of waste water available by 2030 (nearly 50% of Aqueduct capacity),
18 it projects only 2 - 3,000 AF of reclaimed water for M&I by that time (§ 3.2.4.9). The reasons for this pessimistic view are generally

economic and institutional. Yet no firm cost figures on an acre-foot equivalent basis are provided for reclamation or for distribution of reclaimed water.

Instead of providing concrete cost analysis, the report simply asserts that additional measures will be necessary in order to utilize waste water and implies that these measures will somehow be more expensive than the Aqueduct. For example, the report
19 asserts about "Cost: To increase water exchange between Fairfield-Suisun Sewer District and SID in excess of the present contract, expensive new conveyance facilities would be required to transport treated waste water to parts of SID that are much farther from the treatment plant than existing conveyance facilities can reach" (p. 34). This provides no meaningful basis of comparison with the Aqueduct option.

Use of reclaimed water in agriculture is acknowledged to be possible: "use of treated waste water for irrigation is widespread
20 in California, and few problems have been reported" (§ 3.2.3.2.5). Yet no such use in agriculture is factored into the report's conclusions on the waste water option.

Institutionally, the report cites again the problem of water rights transfers, particularly within the Solano Irrigation District. The exchange of SID rights to Lake Berryessa water for waste water
21 is seen as unacceptable to the SID. The Aqueduct-sponsoring agencies have the power and the duty to require the fullest possible utilization of the waste water reclamation potential as a prerequisite to receipt of Aqueduct water. Failure to utilize the waste water potential and to divert more water from the Delta system instead is not "beneficial and reasonable use" under state law.

Mix of Alternatives to the Aqueduct

The report attributes, based on little if any information or
analysis, no water supply potential to groundwater; negligible
supply potential to waste water reclamation; and no supply potential
22 to industrial, commercial, or agricultural water conservation po-
tential. Cost is often cited as a reason for dismissing these options,
yet no economic analysis is performed vis-à-vis the Aqueduct. Ur-
ban, mainly residential, water conservation is evaluated, though
many options within this sector are omitted. Even so, the report
finds a potential in urban conservation to produce over 20,000
AF/year by 2000 in Napa and Solano Counties with a favorable cost
benefit assessment. This small portion of the total alternative
23 potential constitutes nearly 1/3 of the Aqueduct's output, and nearly
1/2 of the supplemental water requirement in 2000 in these counties
(§ 3.2.4.3). Yet the report states the "preferred alternative" to
24 be the Aqueduct (p. 37) in spite of the incomplete and inadequate
technical and economic analysis of the alternatives.

The report provides no basis for preferring the Aqueduct over
the alternatives, given the extremely superficial review provided
of the alternatives' combined potential and economic attractiveness.
Indeed, the preference for Aqueduct construction seems to be in direct
25 contradiction to the expressed policy of at least the Department of
Water Resources to develop nonstructural, reclamation, conservation,
and groundwater options before developing new supply projects.

Finally, while the report has failed to provide even the most
rudimentary economic analysis of most of the alternatives to the
Aqueduct, it has tended to omit the full cost of Aqueduct water de-

livery by failing to factor in the costs of new storage facilities
to increase the capacity of the Delta pool to service the Aqueduct.
26 It is mentioned (p. 136) that such costs will be $100 - $600/AF,
but it is not clear if or where such Delta pool costs are factored
into the Aqueduct construction and O&M costs.

Environmental Analysis of Alternatives

The environmental impact in terms of net outflow of the Aque-
duct's diversions from the Delta pool are considered to be insig-
27 nificant (§ 6.1.2.3.1). No basis for this conclusion is offered.
28 Where will the additional water to service the Aqueduct come from,
and what habitats will be affected? What will be the incremental en-
vironmental impact in the context of the cumulative impacts of the
29 many other Delta diversions (especially the Peripheral Canal) and
pollution discharge (especially the Master Drain) proposals being
advocated by the DWR? These questions are not addressed in the
report.

In addition, the environmental impacts of the nonstructural
30 alternatives--conjunctive groundwater use, conservation, waste water
reclamation--are not evaluated. A comparative environmental analysis
with the Aqueduct is therefore not possible.

Friends of the River
401 San Miguel Way · Sacramento, CA 95819 ·

August 7, 1981

Ronald B. Robie
Director
Department of Water Resources
P.O. Box 388
Sacramento, CA 95802

Re: EIR/EIS for the North Bay Aqueduct

Dear Mr. Robie:

Friends of the River has reviewed the Draft Environmental Report/Statement
(EIR/EIS) for the North Bay Aqueduct (Phase II facilities). We are concerned
that the report is inconsistent with your policies and contains several
major inadequacies that must be corrected in the final EIR/EIS. These
include lack of current need for the project; no analysis of the pre-
1 requisites for conservation, DWR's ability to create those conditions,
or the effects of moving ahead without guarantees of prerequisite reclamation
and conservation measures; grossly inadequate analysis of non-aqueduct
alternatives; missing cost data for all alternatives; and unallowably
shallow discussion of growth, cumulative, and area of origin SWP users impacts.

It strongly appears that the best approach is maximum feasible conservation
and reclamation <u>before</u> the North Bay Aqueduct is built.

The draft EIR/EIS admits in several places that water conservation and
reclamation could forestall the need for the North Bay Aqueduct (See sections
2 3.2.3.1.31, 3.2.3.2.12, 3.2.4.1.) The modest water conservation plan
summarized in Table 3-10 would achieve a reduction in net demand of 20,531
acre-feet.

The draft EIR/EIS admittedly did not even include, "...a number of other
3 measures which could bring about water savings. These measures have not
been quantified because cost and water savings could not be quantified
without additional specific research in the service area." (Section 3.2.3.1.21.)
Similarly, "The conservation potential of the relatively high water use
commercial and industrial sector is not discussed in this plan. While the
conservation potentials within this sector might be significant, more
4 research would be necessary to quantify any possible water saving."
(Section 3.2.3.1.3). These are not simply our own conclusions, based on
the inadequate documentation--these are verbatim admissions by the report's
authors.

The EIR/EIS must fully examine the potential savings from an aggressive
5 municipal and industrial (including commercial) conservation program.
This must reflect the same diligent analysis of local conditions as was
performed for the aqueduct alternative.

<u>Inconsistency with State Policy</u>

The project proponent, DWR, has the stated policy that, "Water resources
already developed shall be used to the maximum extent before new sources
are developed." ("Water Management Policy of the Department of Water
6 Resources," issued by R.B. Robie on May 7, 1975 and revised May 13, 1975).
It is our understanding that the State Water Resources Control Board is con-
sidering adoption of the same policy in its "Policies and Goals for California
Water Management: The Next 20 Years".

This sound policy recognizes the high economic and environmental costs
associated with new water projects. It further recognizes the potentially
cheaper approach of improving water management and end use efficiency to
balance supplies with real needs.

Frequently the erroneous argument is made that even if a facility is not
currently needed, we (the taxpayers) should build it now because it will be
more expensive in the future. The flaw in this argument should, however,
7 be clear: the taxpayers and water customers' unutilized capital will then
be available for other uses which will appreciate in value at rates at least
equal to the inflation in project costs. Building earlier than is necessary
saves no money, and may even cost more.

The draft EIR/EIS must clearly analyze the ability of improved management of
8 existing supplies to meet the gradual increase in water demands. We feel
that this would quite probably show that this capital intensive project can
be deferred for several years.

<u>Inadequate Analysis of Water Conservation/Reclamation Option</u>

The draft report's preferred alternative is to combine water conservation
9 and reclamation with the North Bay Aqueduct and any other supplemental water
sources that may become feasible. (Section 3.4.1) There is no discussion
of what the other supplemental water sources might be.

Unfortunately, the preferred alternative includes no evaluation of the pre-
requisites to assure that water conservation and reclamation will take place.
In fact the report concedes, "With a full-sized aqueduct, local entities
10 would lose some of their incentive to conserve water and develop local water
projects." (Section 3.2.4.10.) Experience has shown that people are less
likely to conserve if they will have to pay for the facilities (e.g. North Bay
Aqueduct) even if not fully used.

The draft report's discussion of the conservation/reclamation/North Bay
Aqueduct Alternative needs to include an analysis of the relative likelihood
of the measures outlined being implemented, DWR's ability to affect that like-
lihood, and additional evaluation of measures which DWR could take which would
11 guarantee the implementation of conservation and reclamation measures. One such
measure would be the adoption of conservation/reclamation amendments to the
State Water Project contracts between Napa and Solano Counties and DWR. Such
amendments would need to be specific as to conservation/reclamation measures,
funding and timing. The EIR/EIS must also analyze the impacts of building the
12 aqueduct should the required measures for the conservation/reclamation program
be uncertain in their impact or require action by another entity not under
the purview of DWR. In these cases, relying on the preferred alternative
would mean moving ahead with a risky project, the possible effects of which
need to be analyzed.

<u>Grossly Inadequate Analysis of Alternatives</u>

We can only assume that the report's authors forgot to include the
section on alternatives. As you can see from the Table of Contents,
13 there is a chapter on, "Environmental Analysis of Alternative Aqueduct
Alignments." This chapter runs 74 pages plus appendices. However, there
is no [illegible] on the impacts of nonaqueduct alternatives!

Undoubtedly your staff is aware of the NEPA regulations which require
proponents to "Devote substantial treatment to each alternative considered
in detail including the proposed action so that reviewers may evaluate
their comparative merits." (Section [illegible]).

[illegible] have to be just that -- alternatives to the
14 proposal. The only nonstructural approaches [illegible] are those included
in the draft report's preferred project and the No Project alternative
[illegible] of Section 3.3.1).

The EIR/EIS must look at the impacts and feasibility of conservation
efforts <u>beyond</u> those included in the draft report's preferred alternative.
15 There is nothing in the record that justifies the arbitrary exclusion of
such measures. **If additional measures are not feasible, the analysis
must document it.**

<u>Missing Cost Data for All Alternatives</u>

The draft EIR/EIS has incomplete information on the aqueduct service
costs and no information on the costs of alternatives. Table 6-3 only
includes total construction, water transport and annual operation and
16 maintenance costs for different aqueduct alignments. Excluded for aqueduct
alternatives are interest during construction, mitigation costs, water
treatment costs, water heating costs, and wastewater treatment and
disposal costs.

To be complete, the economic analysis must also include the costs for
both options: costs of developing this new supply in additional upstream
reservoirs or the costs instead of having existing SWP users suffer more
17 severe deficiencies in dry and critical years. The costs of supplying
this water are not just the aqueduct and O&M costs. The total real costs
for the aqueduct water, both internal and external, must be shown so that
the costs to the users can be identified.

Then the EIR/EIS must identify the costs to the users of conservation and
reclamation measures beyond those included in the preferred alternative.
As no such information has been provided we cannot provide comments specific
18 to this project. However, it has been found with many other resource
development projects that when all costs to the users are included, better
management of existing supplies is a much cheaper and less environmentally
harmful approach than developing new supplies.

Comparable costs to the users of aqueduct water and alternatives (conservation/
reclamation) are also necessary for DWR to meet California Environmental
Quality Act (CEQA) requirements. These prohibit approval of a project
if there are feasible alternatives or feasible mitigation measures
available which would substantially lessen the project's significant
adverse environmental impacts. Only if <u>specific</u> economic, social or other
conditions make infeasible such project alternatives or mitigation measures
can projects be approved in spite of significant effects. (Public Resources
Code Section 21002).

The draft EIR/EIS provides no general or specific evidence of economic,
social or other conditions which would make deferment of the North Bay
19 Aqueduct or additional conservation and reclamation infeasible. Based upon
this record it appears that you are legally prohibited from approving
construction of the North Bay Aqueduct.

<u>Inadequate Analysis of Growth, Cumulative and Area of Origin/SWP User Impacts</u>.

The draft EIR/EIS includes less than three pages on the growth, cumulative
and area of origin impacts. The report indicates only that the new water
20 supply could support a population increase of 387,000 people. It unallow-
ably omits the specific impacts of that many people on air quality, roads,
sewage, treatment capacity, police, fire, social and other governmental
services, open space and agricultural land preservation, etc. Neither does
21 the draft EIR/EIS meet the requirement to discuss the consistency of this
population increase and its location with local general plans and the
State of California's Urban Strategy.

The aqueduct is a major government project being designed to accomodate a
huge increase in the population of two counties. Yet its impacts have
received less analysis than a small subdivision's.

The less than one page description of cumulative impacts does not meet
the CEQA requirements as set forth in <u>Whitman v. Board of Supervisors</u>, 88 Cal.
App. 3d 397 and State EIR Guidelines Sections 15023.5 and 15143(a). These
22 require a list of closely related past, present and reasonably foreseeable
probable future projects producing related or cumulative impacts, including
those projects outside the control of the agency; a summary of the expected
environmental effects of those projects; and a reasonable analysis of their
cumulative impacts.

Other SWP facilities, the Central Valley Project (CVP) and local dam projects
on streams tributary to the Sacramento-San Joaquin Delta have undoubtedly
23 had cumulative impacts on the delta. Although the impacts of the North Bay
Aqueduct might not be overwhelming by themselves, they have more significance
when added to those of all the other projects.

The EIR/EIS must discuss the impacts of the SWP, CVP and local projects
24 on delta water quality, fisheries and recreation. The effects of probable
future projects such as SB 200 facilities are also required to be included.

The discussion of impacts on the area of origin or existing SWP users is
similarly inadequate. It states only that either new reservoirs would have
25 to be built upstream or existing SWP users would have to share larger
deficiencies in dry and critical years. No analysis is provided on the impacts
of additional impoundments or greater deficiencies. Obviously there would be
severe adverse impacts either way.

In essence this draft EIR/EIS attempts to limit the project to the aqueduct only. The source of the water is entirely neglected.

We know that you are committed to fully complying with the letter and spirit of CEQA and NEPA. Therefore, it is a mystery to us how a report with so many deficiencies and so at odds with your own water management policies could have been issued. We look forward to your response.

Sincerely yours,

Elizabeth Andrews

Elizabeth Andrews

[illegible]

State of [illegible]
Department [illegible] Water Resources
Post Office Box [illegible]
Sacramento, CA [illegible]

Attention: Mr. [illegible]

Gentlemen:

The E[illegible]ental I[illegible]pact Report on the [illegible] by [illegible] we are [illegible]able to determine [illegible] until the final route of the [illegible] have been supplied to this office.

1 We would like to point out that PG and E [illegible] any engineering work, acquisition of right[illegible] delivery and construction work, in order to a[illegible] project.

If you have any questions or desire to [illegible] contact Mr. W. E. Bird at (916) 383-4[illegible], Ext. [illegible].

Sincerely,

E. C. [illegible],
Manager, [illegible]

By [illegible]
[illegible]
Division [illegible]

WEB:[illegible]
cc: [illegible]
[illegible]

The Nature Conservancy

July 24, 1981

Mr. Wayne MacRostie, Chief
Central District, Department of Water Resources
3251 S Street
Sacramento, California 95816

Dear Mr. MacRostie:

Thank you for the opportunity to comment on the draft ES/EIR for the North Bay Aqueduct, Phase II project.

The Nature Conservancy's primary concern with this project is the
protection of the Jepson Prairie Project, particularly the
1600 acre Jepson Prairie Preserve (see attached map). Consequently,
1 we endorse Route 1 as biologically least damaging, having a low
cost ranking, and avoiding the Jepson Prairie. Route 4 is our
second-ranked alternative.

This spring, the Conservancy has been conducting biological
inventories on its Preserve. Our botanist located a previously
unmapped colony of the rare and endangered Fritillaria liliacea
2 near Calhoun Cut, as shown on the map. This should be taken into
consideration in regard to Alternatives 2 and 2A, since both
require deepening and widening Calhoun Cut.

We commend the Department of Water Resources for its thorough presentation of facts pertaining to this project, and for the Department's open-mindedness in considering all environmental factors. We would like to work closely with the Deparment in the event that this project directly affects our Preserve.

Sincerely,

Peter Seligmann
Director,
California Field Office

PS/BSMalloch/BE

attachment

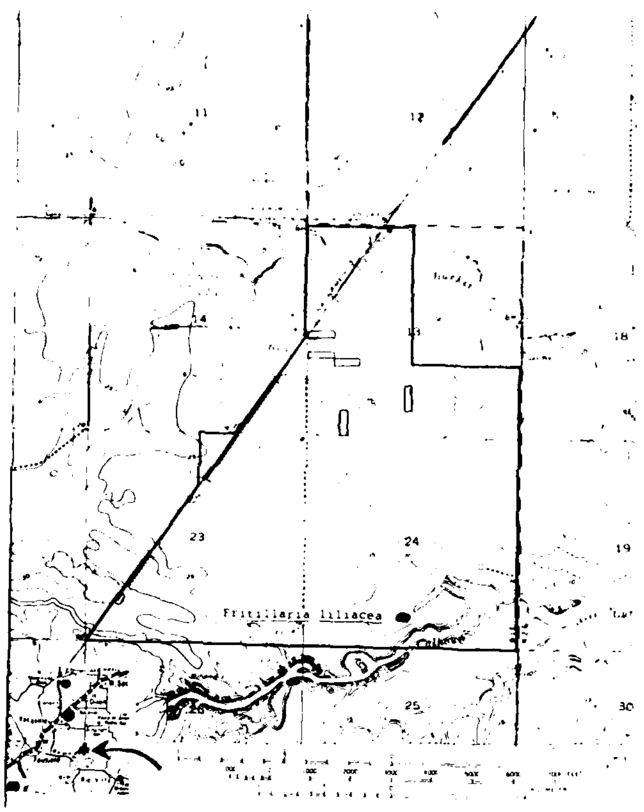


Figure 1. Dozier Tract of the Jepson Prairie Preserve. Inset: general location map.

The Nature Conservancy

August 25, 1981

Mr. Ed Whisman
3251 S Street
Sacramento, CA 95816

Dear Ed:

I have enclosed a partial map of the rare plants occurring on the Jepson Prairie Preserve. My botanical consultant, Bob Holland, has provided me with this preliminary map; the final report is till pending.

As you will note, Fritillaria liliacea occurs on the Sacramento Northern railroad right-of-way southwest of Dozier. This and some other vernal pool species such as Downingia humilis may occur elsewhere on the right-of-way, provided conditions are suitable. Only a survey in spring could determine with certainty their presence or absence.

In my opinion, it is likely that biological impacts from
1 your new alignment could be compensated satisfactorily by a
combination of plant salvage and transplant and land dedication.

I would appreciate an opportunity to review your description and impact analysis of the new alignment.

Sincerely,

Barbara Malloch
California Land Steward

BSM:BE

enclosure

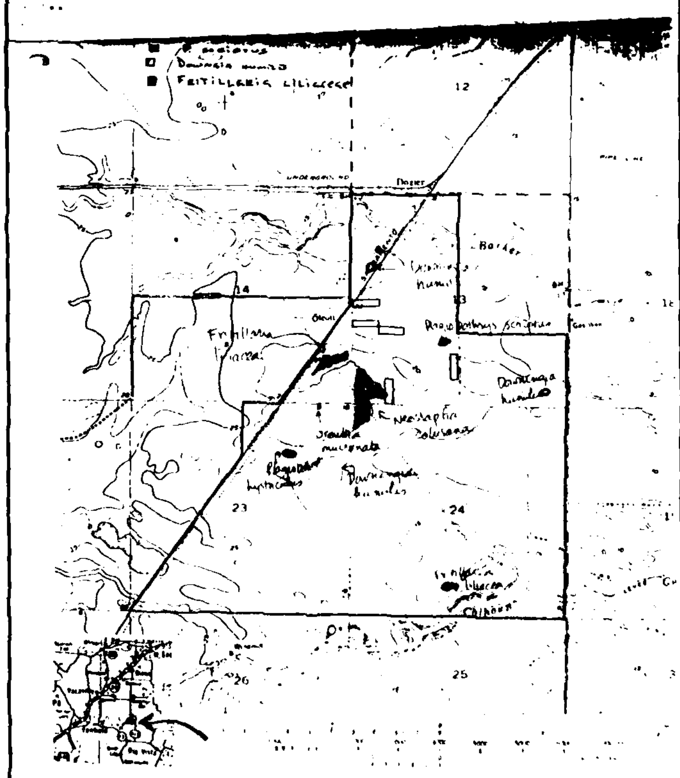


Figure 1. Dozier Tract of the Jepson Prairie Preserve. Inset: general location map.

THE CALIFORNIA NATIVE PLANT SOCIETY

DEDICATED TO THE PRESERVATION OF CALIFORNIA NATIVE FLORA

150 Kerk Road
Corralitos, California 95076
July 25, 1981

Mr. Wayne MacRostie
Chief, Central District
Department of Water Resources
3251 S Street
P.O. Box 160088
Sacramento, California 95816

RE: North Bay Aqueduct - Draft Environmental Impact Statement

Dear Mr. MacRostie:

The California Native Plant Society finds the purpose and need for the North Bay Aqueduct are unconvincing as described in Section 1.0 of the Draft Environmental Impact Statement.

1 If, however, the final EIS demonstrates the project is truly needed, the only alignment we could support is *Alignment 1*. No alignment can skirt all sensitive plant habitats, but Alignment 1 does the best job of avoiding them. And while initial construction for Alignment 1 would cost more than most alternatives, the cost of secondary water transport system construction for Alignment 1 is so low as to make total construction cost for Alignment 1 among the lowest of all the alternatives.

2 Alignment 1 puts the system in a buried pipeline. In a region where soil hydrology is easily unbalanced, this is preferable to an open concrete-lined channel, which would undeniably alter surface runoff patterns. We believe it is important that any construction undertaken be done in such a way that shallow subsurface soil layers are not permanently changed. If the shallow hardpan that forms the basis for the vernal pools is punctured and not refilled to the original density, construction could effectively pull the plug and drain the vernal pools. We propose that soil tests be made along the alignment before construction and the percent of compaction be recorded for each location where the pipeline crosses a junction between two different vegetation patterns and at the center of each vegetation pattern; or every 1,000 meters; whichever is the closer spacing. Then, when fill is replaced, it should be recompacted

Mr. Wayne MacRostie
July 25, 1981
Page Two

to within two percent of its original compaction.

3 We are also concerned that seeding to replant the construction areas should be done with locally native plant species. There is time to engage a specialist to collect and or propagate native seed in the seed seasons before construction (if any) begins.

Thank you for the opportunity to comment on the Draft EIS.

Sincerely,

Suzanne Schettler
State Conservation Coordinator

THE CALIFORNIA NATIVE PLANT SOCIETY

DEDICATED TO THE PRESERVATION OF CALIFORNIA NATIVE FLORA

CNPS Sacramento Valley Chapter
Sacramento Science Center
3615 Auburn Blvd
Sacramento, CA 95821
August 10, 1981

Mr. Wayne MacRostie, Chief
Central District
Department of Water Resources
3251 S Street
P.O. Box 160088
Sacramento, CA 95816

Dear Mr. MacRostie:

1 According to information gleaned from the draft EIS for the North Bay Aqueduct, and also from the HUD draft EIS of Central Solano County Residential Development, the Sacramento Valley Chapter of CNPS can find no urgent reason for construction of the North Bay Aqueduct, Phase II. None of the cities to be supplied are using all the water presently available to them, some, in fact, far from it. With estimated growth, twenty years hence these cities will still need only half as much water as the aqueduct would provide. In addition, conservation measures would yield a reduction in demand of 17% in year 2000.

2 Solano County has 175,000 acres of prime agricultural land, plus an equal amount of potential prime agricultural land which lacks only water. Given the rapid loss of such land in California each year, it would seem a wiser idea to supply water for agriculture than for the city growth which the aqueduct would encourage.

3 Water quality from the proposed pumping areas is not particularly high. If the Peripheral Canal is built there will be changes in the hydrology of the delta. Surely no decision *should be made* to build the aqueduct until the effect of such changes could be evaluated.

4 If, however, the aqueduct might someday be deemed necessary, we feel that Alignment 1 seems the least damaging to the truly unique *Jepson Prairie*, the survival of which is a primary concern of ours. Toward preservation of its vernal pools, we feel it necessary that

5 the underlying soil strata not be altered. Before construction, plants in the right of way should be inventoried, and reseeded *as found, before* intrusive non-natives could invade. Hopefully, Routes 2 and 2a would never be considered because they cross into the Jepson Prairie, and particularly into areas of many sensitive plants, and conflict with the Delta Plan's designation as significant natural resource area.

We appreciate having had this opportunity to make our views known.

Sincerely,

Betty H. Matyas
Conservation Chairman

CALIFORNIA NATIVE PLANT SOCIETY
san francisco bay area chapter

10 Kerr Avenue
Kensington, CA 94707

July 27, 1981

Wayne MacRostie
Department of Water Resources
Central District
3251 South St, P O Box 160088
Sacramento, CA 95816

Dear Mr MacRostie,

Thank you for the opportunity to comment on the Draft EIR/EIS on the North Bay Aqueduct.

We fully support the recommendations for waste water reclamation and water conservation set forth in section 3.2.3.

The no project alternative seems desirable in the short term en-
1 vironmentally and in that it would stimulate waste water reclamation
and water conservation programs, but could have adverse effects through
increased ground water pumping and through increased pressure to construct
other water supply delivery systems, the environmental effects of which
are now unknown.

The draft EIR/EIS does not adequately address the extent to which
2 the aqueduct, by increasing the water supply to Napa and Solano Counties,
would stimulate development, thus creating additional demand for services.
This demand spiral should be fully considered in the final EIR.

If the need for a North Bay Aqueduct merits the construction of such
an aqueduct, our main concern is the protection of the vernal pools in
3 the area, and of the conditions which make such pools possible. We are
deeply concerned about any excavation that would affect drainage in the
area of the Jepson Prairie.

We could support the choice of alignment 1 as described in the draft.
Although both alignments 1 and 4 appear to have been well thought out,
4 alignment 4 crosses the sensitive vernal pool area, and on the map in
figure 6-10 is shown to cross rare plant habitats.

Alignment 1 has advantages environmentally of avoiding such sensitive areas, of following existing property lines for the most part, and of

DEDICATED TO THE PRESERVATION OF CALIFORNIA NATIVE FLORA

being a pipeline.

Even the choice of alignment 1, however, raises environmental
concerns. Ours is that the existing grassland be restored after con-
struction. The composition and compaction of the soil, and the com-
5 position of the vegetation are are main concerns in this regard.

By sampling the soils before construction, a plan to restore the fill to the condition of the surrounding soils could be worked out.

Seeding of the disturbed area will be necessary for erosion control purposes. So that competitive or invasive alien plant materials are not introduced, we recommend that a plan to reseed with material collected on site be prepared. There is ample time to consult with an expert with experience in matching vegetation.

Alignment 1 also appears to be cost effective. Although construction
costs are somewhat high, as shown in Table 4-3, the secondary construction
6 costs are low est, so total construction costs are comparatively low.

Operation and maintenance figures, while slightly higher than for the other alignments, are offset by the fact that this alignment requires the least secondary power. Because of the markedly lower power use, alignment 1 may prove over the years, to be the <u>least</u> expensive of the proposed alternatives.

Sincerely,

Charlice W Danielsen
Charlice W Danielsen
Chapter President

State Senator
Jim Nielsen
Fourth District
Napa, Sacramento, Solano, Sonoma, and Yolo Counties

July 29, 1981

Ronald Robie, Director
Department of Water Resources
1416 Ninth Street
Sacramento, California 95814

Dear Ron:

Please accept this letter as my official comments on the draft Environmental Impact Report (EIR) on the North Bay Aqueduct. Unfortunately, I will be unable to attend tonight's public hearing, due to your department's failure to notify me.

First of all, I am totally supportive of the EIR's conclusion that an aqueduct be built. I believe the EIR provides an extensive and thorough review of the issues involved with the project. The need for the North Bay Aqueduct has been clearly confirmed.

Secondly, I am adamant that decisions relative to
capacity, routing and implementation of water conservation
1 measures be made at the local level. Department officials
have verbally assured me that this will be the case and
I would be greatly disappointed if it is not.

Lastly, I am concerned with any possible further
delays in this project. The Department should make every
effort to complete construction of the North Bay Aqueduct
2 by the original 1984 date. This is extremely important
in both terms of need and cost.

I am committed to continuing my involvement in coordinating state and local agencies' actions on all aspects of this project.

Thank you.

Sincerely,

Jim Nielsen
JIM NIELSEN

DOWNEY BRAND SEYMOUR & ROHWER

August 11, 1981

Department of Water Resources
Central District
3251 S Street
P.O. Box 160088
Sacramento, California 95861

Attention: Wayne MacRostie, Chief

RE: Comments on Draft ES/EIR
North Bay Aqueduct
(Phase II Facilities)
Solano County, California

Dear Mr. MacRostie:

This firm represents members of the Vassar family of Dixon, California, owners and tenants of a large tract of land in the immediate vicinity of the beginning point for alternate Route I of the Phase II portion of the North Bay Aqueduct. Immediately adjacent to our clients' property is the point where a pumping plant is proposed for the removal of water from Cache Slough to be then carried through a pipeline under fields owned by my clients, which fields consist of more than 270 acres.

In addition to these 270 acres, from the presentation made at the public hearing in Fairfield on July 29, 1981 which was attended by some members of the Vassar family, it would appear as if alternate Route I during its construction phase will affect adversely the irrigation distribution system across much of the Vassar tract to the extent that more than 500 acres could be out of production for the growing season which brackets the construction phase. This land, during the 1980-81 crop year, netted our clients in excess of $450.00 per acre. With continued inflation, the contemplated damages to our clients can only increase as the commencement date for construction approaches.

Page [illegible]

[illegible] clients are also concerned about their ability to traverse the pipeline route after construction completion with what is now an open ditch irrigation distribution system.

It is our understanding that Phase II is [illegible] buried pipeline of sufficient depth that agricultural row crop operations can continue following construction. We are,
1 however, concerned with the backfill which will be utilized as well as your access rights to the easement following the anticipated taking. The land in question is fenced and cross-fenced, being part of a mixed livestock-farming operation, and therefore fencing problems and access by outsiders is of considerable importance.

In reviewing the EIR, it would seem that the poor water quality in Cache Slough should not be minimized in selecting a beginning point for the system. Likewise, a route further to the north, even using the same water
2 source, which would parallel existing roads and field boundaries would have a much less adverse effect to the agricultural operations in the vicinity of the pipeline than the presently proposed Route I.

In summary, we would appreciate the opportunity to discuss our individual problems with those directly involved with the project in greater detail and before
3 there is so much inflexibility built into the plans that all we could contemplate is an acrimonious debate with the government agencies involved over the amount and extent of my clients' damages.

Yours truly,

DOWNEY, BRAND, SEYMOUR & ROHWER

BY: [illegible]

HER:lac
cc: Vassar family

2220 Boynton St. Suite C
Fairfield CA 94533
(707) 429-4[illegible]

JG

3801 Novato Blvd
Novato CA 94947
415 897 [illegible]

JAMES GROSSI, JR., INC
Civil Engineer
Land Planner

[illegible] 28, 1981

[illegible]

RE: Draft Environmental Statement Environmental Impact Report, North Bay Aqueduct

Dear Mr. MacRostie:

[illegible] the referenced document, it has come to our attention that Route No. I as proposed, encroaches on the lands of Citation Homes, whom we represent. The portion in question is delineated on "Segment Map 5" [illegible] "RP10 and RP11".

The project of Citation Homes, more commonly referred to as the "Greenvale Planned Unit Development", has been in the planning process for more than three years. The project has been prezoned "P.D." in the City of Fairfield and has a certified Final EIR.

The conflict with Route No. I is shown on the attached "P.D. Plan". The proposed location of the Aqueduct is delineated in red. The proposed [illegible] conflicts with lots, streets and utilities in many areas.

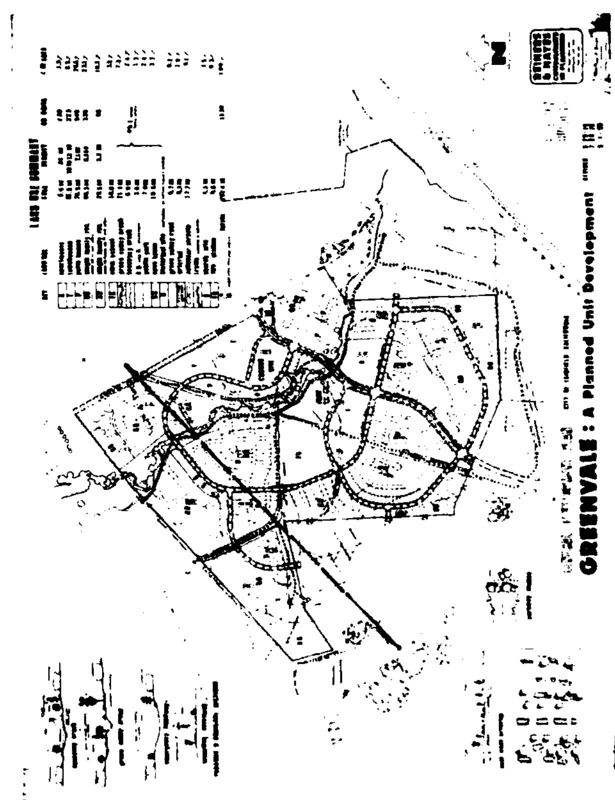
We ask that either Route 2 be chosen as the preferred alignment or that Route 1 be modified. A realignment of a portion of the aqueduct to a
1 position parallel to and adjacent to the existing Putah South Canal would result in most [illegible] conflicts. The canal designates the Urban Limit Line for the City of Fairfield, and therefore no development is planned in the near future north of the canal, thus less conflicts will occur.

We are available to meet with you to discuss this matter further.

Sincerely,

James [illegible]

cc: [illegible], Citation Homes
Joseph [illegible], City of Fairfield



BEN W. ALLUSTIARTE
[illegible]
MODESTO CALIFORNIA
[illegible]

August 5, 1981

State Department of Water Resources
P. O. Box 16008
Sacramento, California 95816

Attention: Wayne Mac Rostie

Dear Mr. Mac Rostie:

Thank you for the time given me to express my concern about the North Bay Aqueduct in Fairfield, California the evening of July 29, 1981.

1 My family and I are totally against Route #1 as it is proposed in the Draft Environmental Statement and the Environmental Impact report dated June, 1981.

2 I do not think the Doctor who drew the Jepson Prairie Map, outlining the Vernal Pools, is qualified to draw maps for the State of California designating the Vernal Pool areas. Vernal Pools are nothing but alkali pools that water cannot completely penetrate during heavy rains.

3 Route #1 has more faults than any other routes in the draft report:

1. It is <u>not</u> the cheapest route.
2. It is <u>not</u> the least expensive to operate.
3. It disturbs the environment.
4. It also has Vernal Pools and is similar to land in Jepson Prairie.
5. It disturbs miles of prime irrigated land of which 3½ miles belongs to the Allustiarte families.

4 It is also against the wishes of Napa County who favor Route #2 as the most efficient and less costly. As stated in the Vallejo Times Herald newspaper on the front page by Harry Hamilton, Napa County's director of public works, Flood Control and Water Conservation District and who expect to pay approximately 40% of the total project cost.

American Canyon Water District also support Route #2 because of its lower costs.

5 Cost is very important for those who have to pay for the project, but <u>not</u> to those that will not spend a dime. Route #2 is 3 million dollars cheaper

Page 2
Mr. Mac Rostie
August 5, 1981

to build, and $300,000 cheaper per year to maintain. These are figures given by the Department of Water Resources.

Route #2 - $46.3 M Construction
1.1 M Annual Expense
Total $47.4 M

Route #1 - $49.[illegible] M Construction
1.4 M Annual Expense
Total [illegible]

6 The Allustiarte families are against Route #1 because of the above reasons 100% and recommend Routes #2 or Route #[illegible] only.

In the event you are considering Route #1 against our wishes, we would want a 30-day prior notice in order to consult our attorneys.

NOTICE: is hereby given that lengthy legal action will commence.

Sincerely,

Ben W. Allustiarte

Ben W. Allustiarte
For Allustiarte Families

BWA/la

CC: Edward E. Whisman

Richard Emigh
98 Bruning Avenue
Rio Vista, California 94571

August 5, 1981

<u>Re: NORTH BAY AQUEDUCT (Phase II-Facility)</u>

Regarding your meeting in Fairfield, California on July 29th.

1 My first choice is Route 1. It is the most practical for all concerned. My second choice would be an open canal from Calhoun Slough to pumping station, and then Route 2A to next pumping station along Creed Road.

Sincerely,

Richard M. Emigh

Richard M. Emigh

ROGER W. SOUZA
1851 Green Valley Road
Suisun California 94585
Telephone 707 864 1274

August 1, 1981

Calif nia Department of Water Resources
Box 1600088
Sacramento, Ca. 95816

Gentlemen:

Re: North Bay Aqueduct (PhaseII - Facility - Draft - June 1981)

1) I would appreciate being placed on your mailing list. Its very embarrassing to receive the draft and notice from a Tenant, who lives in Bakersfield.

2) Re: Our Parcel 726 Acres +/- Denverton & Creed Roads - plat enclosed.

a) Routes 2,3,4,5,6 & 7 all will affect our property.

b) If the state continues its present highway plans, although we have a mile frontage on Highway 12; we will have no access. If routes 2A, 4, 5, 6, or 7, and an open canal is used we will have to take the position that there will have to be access bridges provided over the canal to meet city and county tandards for the future of our property; or we will also be landlocked in he Northern Portion.

c) Because of the dangerous faulting area which you indicate as Kirby Hills Fault; it would appear that this area should only have the underground piping system, because gas tests and drilling have already indicated this fault is 100-120 feet deep, and the width is unknown.

d) No matter how you look at our property it appears its going to be costly to develop.

e) If its in the little triangle near the Denverton and Creed Roads, this will virtually landlock the Northern part of the property because the State Highways systems does not provide an access yet from Denverton or Brascomb Road. So you could be involved in a total condemnation.

3) The owners of this property did not purchase this property for agricultural purposes; but for future potential over the next twenty years and therefore it is not under an agricultural preserve.

4) From the above it would appear that Route 1 would be the only route that

ROGER W. SOUZA
1851 Green Valley Road
Suisun California 94585
Telephone 707 864 1274

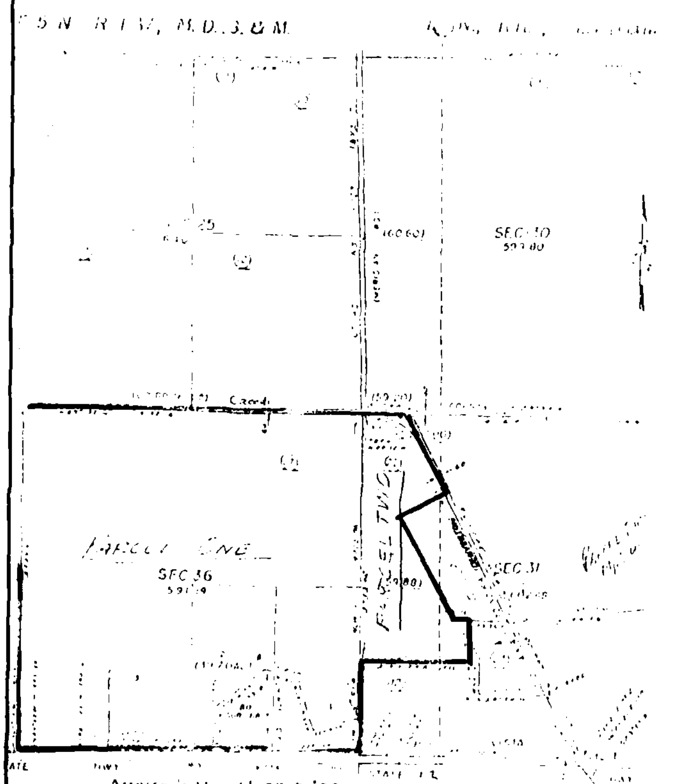
4) would not affect our property, and therefore we would support this route.

Sincerely,

AIRPORT VISTA ASSOCIATES

By ______________________
Roger W. Souza

Representing:
Mark M. Rubenstein, M. D.
Dr. and Mrs. Alan P. Burckin
Dr. and MRs. Donald J. Paluska
M. M. Palaganas
Mamerto C. Palaganas, M. D.
Dr. and Mrs. William Lee
Dr. and Mrs. William Liebman
Mr. and Mrs. Richard C. Murray, Jr.
Mr. and Mrs. Roger W. Souza
Mr. and Mrs. Robert Pastorino
Margaret Lois Carlson
Dr. and Mrs. Richard D. Hyman
Dr. and Mrs. Russell J. Erickson
J. D. Smith



Assessor's Map Bk.39 Pg 22
County of Solano, Calif

Commenting Entity: Environmental Defense Fund
August 6, 1981

Response 1

The Department of Water Resources has comprehensively reviewed and updated the information contained in Chapter 3.0 of the Draft ES/EIR. Details are included in Section 1 of the Final ES/EIR. Changes made to Chapter 3.0 as a result of this investigation include:

° Updating, correcting, and expanding information on all water supply alternatives, population projections, municipal and industrial (M&I) water demands, and anticipated M&I supplemental water requirements.

° Developing comprehensive draft urban water conservation plans for Solano and Napa counties that specify possible conservation measures for all North Bay Aqueduct contracting agencies and provide important mitigation for fishery impacts by extending contract entitlement buildup schedules and correspondingly delaying North Bay Aqueduct annual diversion increases.

° Revising the preferred water supply alternative to insure implementation of reasonable and enforceable water conservation programs for Solano and Napa counties.

° Addition of an environmental impact review of various alternative water supplies that could potentially supplement the North Bay Aqueduct.

These changes and others made to the Draft ES/EIR are indicated in Section 3, Corrections and Additions to the Draft ES/EIR. Draft urban water conservation plans developed by the Department of Water Resources for Solano and Napa counties are presented in Appendices II and III of the Final ES/EIR.

Results of the investigation confirm several conclusions of the Draft ES/EIR:

° The North Bay Aqueduct is needed before 1990 as a firm supply to meet the supplemental M&I water requirements for Solano and Napa counties.

° The combined total potential supply from all alternative sources will not provide a firm M&I supply sufficient to meet the supplemental water demands for Solano and Napa counties without the North Bay Aqueduct, and therefore the combined alternative supplies cannot independently constitute an alternative to the North Bay Aqueduct.

° Alternative supplies to the North Bay Aqueduct can provide an additional source of M&I water and water conservation measures can delay the future M&I demands in Solano and Napa counties, which will significantly complement North Bay Aqueduct deliveries and extend the adequacy of this facility to meet demands beyond contracted entitlement buildup schedules.

° Use of existing supplies has been maximized in accordance with State Water Resources Management Policy.

A reexamination of conclusions drawn in Section 3.2.2.1 of the Draft ES/EIR has resulted in a revised estimate of safe yield for ground water supply in Solano County to 131,700 acre-feet per year, reflecting the findings of the "Water Action Plan for the Southwest Sacramento Valley Service Area". This memorandum report, prepared by the Department of Water Resources in October 1980, was based on a land-use survey conducted by the Department and a review of historical ground water pumping, precipitation, and ground water levels. (See Section 1, under Ground Water Supply Development.)

Response 2

As discussed in Section 3.2.3.1.27 of the Draft ES/EIR and corrected for the Final ES/EIR, an increase of 21,600 acre-feet in applied agricultural water demand is projected by the year 2000. This is primarily due to a substantial amount of unirrigated agricultural land expected to be irrigated by that time. Consequently, anticipated agricultural water conservation savings through reuse of drainage water will be needed to irrigate these "new" agricultural lands. The Department of Water Resources supports the use of agricultural water conservation measures for Solano and Napa counties, as outlined on page 29 of the Draft ES/EIR. (See Response 16 and Section 1, under Conjunctive Use of Surface and Ground Water.)

Response 3

The term "safe supply" is used interchangeably with "safe yield". (See Response 1.)

Response 4

The range of estimates for potential ground water supply presented in the Draft ES/EIR reflected findings of several documents and was not a statistical range. The estimate of safe yield has been revised in the Final ES/EIR. (See Response 1.)

Response 5

Comment acknowledged. Because estimated safe yield of ground water approximates that currently pumped on an average basis, there are no additional ground water supplies available for municipal use. (See Section 1, under Ground Water Supply Development.)

Response 6

See Response 2. Additional conservation, in the sense of reducing outflow of agricultural drainage water, will enable more agricultural acreage to be irrigated. Reducing ground water pumping for application to crops would not increase the overall supply available to the basin.

Response 7

The conclusions in the Draft ES/EIR with respect to conjunctive use of ground water have been revised. (See Section 1, under Conjunctive Use of Surface and Ground Water Supplies.)

Response 8

See Responses 1 and 7.

Response 9

The estimated range of safe yield for ground water supply development in Napa County presented in the Draft ES/EIR represented the conclusions of several documents and was not a statistical range.

Response 10

The Draft ES/EIR has been revised to indicate that, as a reasonable approximation, the safe yield of ground water in Napa County is equal to the present average annual pumpage, or about 10,500 acre-feet. (See Section 3.)

Response 11

See Responses 1, 5, and 10.

Response 12

Possible water conservation measures for all North Bay Aqueduct contracting agencies have been added to the Final ES/EIR. A general description of these measures is presented in Appendix I. These measures are used in draft urban water conservation plans for Solano and Napa counties, which are included as Appendices II and III of this final report. The measures presented in these draft plans include measures currently implemented in the service areas and add new measures suited to the character and needs of the service area. Negotiations in progress between the Department of Water Resources and North Bay Aqueduct contracting agencies are designed to establish conservation programs that will be implemented through enforceable institutional means. These programs could include goals or specific conservation measures. Such programs will be reasonable, practical, and economically achievable. The draft urban water conservation plans are being reviewed in current negotiations. The Final ES/EIR also presents potential water savings that correspond to conservation measures and these savings could be the framework for the goals of a water conservation program.

The urban water conservation will not reduce the maximum North Bay Aqueduct annual contracted entitlements; however, these programs will extend the entitlement buildup schedules further into the future. The Department has set a first priority for the use of available nonproject funds to offset a portion of the costs associated with implementing the programs and use of project funds to finance parts of the plans. In addition, the Department will negotiate rescheduling of contracted annual entitlement deliveries to compensate for water conservation savings and new demand predictions. This rescheduling can spread the existing delivery schedule volumes over a longer period of time, thereby delaying annual delivery increases and payments. (See Section 1, under Urban Water Conservation and Supplemental M&I Needs.)

Response 13

The draft urban conservation plans include potential savings in the commercial and industrial sectors. (See Section 1, under Urban Water Conservation and Supplemental M&I Needs, and Section 3.)

Response 14

Pricing policy evaluations to reduce water consumption are addressed in the recommended urban water conservation plans, Appendices II and III.

Response 15

See Responses 12, 13, and 14.

Response 16

Most of the issues addressed in this comment are discussed in the Draft ES/EIR. Irrigation efficiency is discussed in paragraph 3.2.3.1.23; low leaching requirement in the area is discussed in paragraph 3.2.3.1.24; methods for reducing ET are discussed in paragraphs 3.2.3.1.25 and .26; crop switching and introduction of crops with a lower ET demand are discussed in paragraph 3.2.3.1.26.

The Department reviewed the agricultural supply, demand, and supplemental applied water needs for Solano County and found that values presented in the Draft ES/EIR were not consistent with information presented in M&I uses and supplies, which was obtained from the Department's "Water Action Plan for the Southwest Sacramento Valley Service Area". The corrected values in the Final ES/EIR show a decrease from the draft report of about 5,000 acre-feet per year in the year 2000 for agricultural supplemental applied water needs and an increase of about 10,000 acre-feet of new agricultural supplies that can be obtained from the reuse of agricultural drainage water. The Draft ES/EIR indicated that 26,700 acre-feet of agricultural supplemental applied water would be needed in the year 2000. Based on the Water Action Plan, the total supplemental requirements were reduced to 18,100 acre-feet in 1990 and to

21,600 acre-feet in 2000. Also, to be consistent with the Water Action Plan, the 4,000-acre-foot estimate in the Draft ES/EIR for potential reuse of agricultural drainage water was corrected to 14,000 acre-feet. These values show that in the year 2000 a 7,600 acre-foot per year agricultural requirement will exist after all potential reuse supplies are used. (See Section 1, Table 3-6(F).)

The Department of Water Resources supports the use of agricultural water conservation measures by Solano and Napa counties, as outlined on page 29 of the Draft ES/EIR. The Department's commitment is defined in DWR/SWRCB Bulletin 4, "Policies and Goals for California Water Management: The Next 20 Years", June 1981. The Department has funded programs that will advance our knowledge and efforts in the area of agricultural water conservation. These include work being done by the Department's Office of Water Conservation and Department work being done in connection with the Governor's Executive Order B-68-80. Current institutional and economic constraints make it difficult to define firm water supplies that could be developed from conservation practices and exchanged for M&I supplemental water supplies for Solano and Napa counties, which are needed before 1990. In addition, the Draft ES/IER, on page 30, paragraph 3.2.3.1.28, explains that although the Solano Project agricultural service area provides the physical means (Putah South Canal) to transport agricultural water savings achieved within its boundaries into water supplies for the cities served by the same project, any water savings achieved in the other scattered agricultural areas would be difficult and costly to collect and transport for municipal use. In addition, transport of any "surplus" agricultural water through the Putah South Canal could also be prohibited because of existing downstream water quality commitments.

Response 17

See Response 16.

Response 18

The information on the waste water reclamation alternative presented in the Draft ES/EIR has been revised. (See Section 1, under Waste Water Reclamation, and Section 3.)

Response 19

See Response 18. Cost information is available for this waste water reclamation alternative and is compared to the marginal cost of new fresh water supplies for the State Water Project.

Response 20

See Response 18.

Response 21

The Solano Irrigation District has a contractual agreement with the Fairfield Suisun Sewer District for exchange of up to 6,000 acre-feet of Solano Project water for an equal amount of waste water. SID uses slightly more than half of the full contract amount and has had difficulty in identifying additional uses for treated waste water that are within economic transmission distances from the treatment plant. (Also see Section 1, under Waste Water Reclamation.)

Response 22

See Responses 1, 5, 12, 13, 16, 17, and 18.

Response 23

On the basis of recent changes in population estimates and an update of per capita use rates, supplemental water requirements for Solano and Napa counties have been adjusted in the Final ES/EIR. The Department of Water Resources has comprehensively reviewed and updated the information contained in Chapter 3.0 of the Draft ES/EIR. This review has shown that the North Bay Aqueduct is needed before 1990 as a firm supply to meet the supplemental M&I water requirements for Solano and Napa counties. Comprehensive draft urban water conservation programs have been developed for North Bay Aqueduct counties that show possible conservation measures for all North Bay Aqueduct contracting agencies and provide important mitigation for fishery impacts by delaying scheduled water delivery increases, thereby correspondingly delaying annual diversion increases. (See Response 1 and Section 1, under Urban Water Conservation and Supplemental M&I Needs.)

Response 24

The preferred alternative for water management in Solano and Napa counties includes construction of the North Bay Aqueduct and implementation of reasonable and enforceable urban water conservation programs. (Also see Response 1 to this letter.)

Response 25

See Section 1.

Response 26

The repayment cost of the North Bay Aqueduct includes a Delta Water Charge and Transportation Charge, which include Delta pool, operation and maintenance, and construction costs. All State Water Project water supply contractors will share in the costs of developing a supplemental supply for the Delta pool. Actual costs will depend on which additional storage and delivery facilities are constructed and when. Presently estimateed costs are fully presented in Bulletin 132-81, "The California State Water Project -- Current Activities and

Future Management Plans", Department of Water Resources, November 1981. (See Section 3, correction and addition to page 47, paragraph 4.3.4.)

Response 27

New information has been added to the Final ES/EIR on the relationship between past, present, and future water development, the North Bay Aqueduct, and Delta outflow. Also, mitigation measures the Department plans to take with regard to possible mulative impacts have been added. This information is presented in Response 1 to the comment letter from the U. S. Environmental Protection Agency and Section 3, Corrections and Additions to the Draft ES/EIR. Additional information in connection with the North Bay Aqueduct diversion and Delta outflow is presented in Appendix F of the Draft ES/EIR. This appendix describes the methodology and findings of a computer analysis of water quality and hydraulic impacts associated with the proposed aqueduct diversion under worst-case conditions. The evaluation in Bulletin 76 is presented in Response 1 to the U. S. Environmental Protection Agency letter. Bulletin 76 shows how future Delta diversions are planned to be properly replaced by project releases from present and proposed facilities. These releases are planned to guarantee Delta outflows to protect the Delta's environment and beneficial water uses. The ratio of the North Bay Aqueduct diversion to the flow of the Sacramento River at Rio Vista would be about 11.5 percent of the minimum monthly protective flow in July in a critical year as set by the State Water Resources Control Board in Water Rights Decision 1485 criteria. For April-June of the critical years, the average ratio of Aqueduct diversion to Sacramento River flows, as computed by operation studies of actual historical hydrology, would be only 2 percent. Critical years occur on the average of once every 10 years. Furthermore, the North Bay Aqueduct diversions represent only 0.7 percent of average Sacramento River flows and only 0.002 percent of wet year flows. In critical years and during summer months, the Delta is normally under controlled flow conditions. During this controlled condition, all North Bay Aqueduct diversions will be replaced by releases from project storage and therefore protective Sacramento River flows will be maintained.

Response 28

As explained in paragraph 6.1.2.3.2 and illustrated in Figure 6-13 of the Draft ES/EIR, a number of projects are planned to increase the firm yield of the State Water Project. These projects, which include construction of new water storage reservoirs, pumping facilities, and conjunctive use of ground water, are subject to separate environmental review. Impacts such as habitat loss associated with these projects will be described and mitigation measures developed. (Also see Response 1 to comment letter from the U. S. Environmental Protection Agency.)

Response 29

As discussed in paragraph 6.1.2.3.4, modeling studies to examine effects of the Peripheral Canal on hydraulic conditions near the proposed North Bay Aqueduct diversion indicated no significant water quality impact. This is partly due to the requirement of State Water Resources Control Board

Decision 1485 for a minimum flow of 1,000 cubic feet per second in the Sacramento River at Rio Vista. With respect to other future water projects affecting the Delta (e.g., San Luis drain), DWR fully recognizes its responsibility to meet all water quality standards established in the Delta. Maintenance of these standards will insure that Delta outflows are not reduced during controlled flow periods. During periods of controlled Delta outflows, the North Bay Aqueduct diversions will be replaced by upstream projects to assure compliance with Decision 1485 standards. Water quality and flow criteria established to protect the Delta by Water Rights Decision 1485 take priority over SWP diversions. Diversions for the North Bay Aqueduct will contribute to project reductions of uncontrolled Delta outflows. These reductions are minor. The 50-year average of all year types of uncontrolled flow is about 22,000 cfs. The maximum North Bay Aqueduct diversion represents about 0.5 percent reduction in these uncontrolled flows. This will have some cumulative effect on the Bay-Delta estuary environment. (See Response 1 to letter from U. S. Environmental Protection Agency.)

Response 30

The environmental impacts associated with alternative M&I water supplies are addressed in Section 1 of the Final ES/EIR. Environmental impacts were used in the alternative selection process. On the basis of an extensive review of available information by DWR concerning water supply alternatives, it was determined that a combination of these supplies could not provide a firm M&I supply for Solano and Napa counties without the North Bay Aqueduct. Therefore these supplies cannot independently constitute an alternative to the North Bay Aqueduct.

Commenting Entity: Friends of the River
August 7, 1981

Response 1

The Department of Water Resources has comprehensively reviewed and updated the information contained in Chapter 3.0 of the Draft ES/EIR. Details are included in Section 1 of the Final ES/EIR. Changes made to Chapter 3.0 as a result of this investigation include:

- Updating, correcting, and expanding information on all water supply alternatives, population projections, municipal and industrial (M&I) water demands, and anticipated M&I supplemental water requirements.

- Developing comprehensive draft urban water conservation plans for Solano and Napa counties that specify possible conservation measures for all North Bay Aqueduct contracting agencies and provide important mitigation for fishery impacts by delaying scheduled water delivery increases.

- Revising the preferred water supply alternative to insure implementation of reasonable and enforceable water conservation programs for Solano and Napa counties.

- Addition of an environmental impact review of various alternative water supplies that could potentially supplement the North Bay Aqueduct.

These changes and others made to the Draft ES/EIR are indicated in Section 3, Corrections and Additions to the Draft ES/EIR. Draft urban water conservation plans developed by the Department of Water Resources for Solano and Napa counties are presented in Appendices II and III of the Final ES/EIR.

Results of the investigation confirm several conclusions of the Draft ES/EIR:

- The North Bay Aqueduct is needed before 1990 as a firm supply to meet the supplemental M&I water requirements for Solano and Napa counties.

- The combined total potential supply from all alternative sources will not provide a firm M&I supply sufficient to meet the supplemental water demands for Solano and Napa counties without the North Bay Aqueduct, and therefore the combined alternative supplies cannot independently constitute an alternative to the North Bay Aqueduct.

- Alternative supplies to the North Bay Aqueduct can provide an additional source of M&I water and water conservation measures can delay the future M&I demands in Solano and Napa counties, which will significantly complement North Bay Aqueduct deliveries and extend the adequacy of this facility to meet demands beyond the contract entitlement buildup schedules.

- Use of existing supplies has been maximized in accordance with State Water Resources Management Policy.

Response 2

The Department has prepared revised and more detailed water conservation plans for Solano and Napa counties. These plans, presented as Appendices II and III in the Final ES/EIR, include a number of possible measures beyond those considered in the draft report. See Response 1 and Section 1.

Response 3

See Response 1, Section 1 (Urban Water Conservation and Supplemental M&I Needs), and Appendices II and III.

Response 4

The potential for conservation in the commercial and industrial sector is considered in the revised analysis and included in the preferred alternative as urban conservation programs. Appendices II and III present updated urban water conservation information and plans for Solano and Napa counties.

Response 5

See Responses 1 and 4, and Section 1.

Response 6

The preferred alternative is consistent with the goals and policies of the Department of Water Resources. (See Response 1 and Section 1.)

Response 7

This argument is essentially correct. However, as stated in Section 1, the Department has concluded that the North Bay Aqueduct will be needed as a firm supply before 1990. Also, as a result of the Department's reexamination of potential water demands and needs, adjustments in annual contracted entitlement buildup schedules are part of negotiations for finalization of the urban water conservation programs. These adjustments, if requested, will bring payments under the Delta Water Charge in line with lower rates of demand buildup due to the water conservation plans and lesser rates of population growth than contemplated when the contracts were executed in the early 1960s. (See Response 1 to this letter and Section 1.)

Response 8

The reevaluation of possible alternatives to the aqueduct confirmed the conclusion of the Draft ES/EIR that the aqueduct will be necessary to meet demands for supplemental water in Solano and Napa counties before 1990.

Response 9

The preferred alternative in the Final ES/EIR includes only the North Bay Aqueduct plus reasonable and enforceable urban water conservation programs. Other supplemental sources may include future waste water reuse and some yield from conjunctive use of surface and ground water if the potential is not all used for agriculture. (See Section 1.)

Response 10

The preferred alternative has been modified to include urban water conservation programs that can be enforced by institutional means. Draft conservation plans have been developed for the Final ES/EIR and are being reviewed in negotiations between the Department of Water Resources and North Bay Aqueduct contracting agencies. The plans are designed to finalize the conservation programs. These draft plans are in Appendices II and III and suggest possible measures, funding, and timing. In addition, the Department is reviewing extensions of contracted entitlement buildup schedules, which will lower costs and provide an incentive to conserve. (See Response 1 to this letter and Section 1.)

Response 11

See Responses 1 and 10.

Response 12

As explained in Section 1, the need for the North Bay Aqueduct before 1990 as a firm supply has been confirmed. In addition, in Section 1, under Waste Water Reclamation, reuse of water has been examined in greater detail than in the Draft ES/EIR and has been found to have limited potential at this time because of economic factors. Means are described in the Final ES/EIR to insure implementation of urban water conservation measures. The evaluation of the impacts associated with the North Bay Aqueduct assumes a worst-case condition. The construction impacts evaluate the full design features of the pipe and pumping station. Impacts associated with the North Bay Aqueduct Delta diversions and growth-inducing impacts assume maximum entitlement diversions. (See also Response 7.)

Response 13

Further investigations for the Final ES/EIR have confirmed that there are no fully adequate alternatives to the North Bay Aqueduct. Partial alternatives or supplements to the aqueduct, including a discussion of anticipated constraints and impacts, are the focus of Chapter 3.0 of the Draft ES/EIR. Much of the information in this chapter has been expanded and updated and is included in Sections 1 and 3 of the Final ES/EIR. As noted in Section 3.4 of the Draft ES/EIR, a potentially significant nonstructural alternative is water conservation. Water conservation is included as part of the preferred alternative for Solano and Napa counties. Information on water conservation in the draft report has been further expanded in the Final ES/EIR.

Response 14

See Response 13.

Response 15

See Responses 1, 2, 3, 13, and 14.

Response 16

Table 4-3 consists of major costs of SWP deliveries of a raw water supply for the North Bay Aqueduct that can be reasonably estimated, including mitigation costs. The water conservation programs included in the preferred alternative for the Final ES/EIR will delay contracted entitlement buildup schedules and thereby reduce the cost of water treatment, water heating, and waste water treatment and disposal. Delta water supplies for all North Bay Aqueduct alignments will not have significantly different costs for the items listed

above. Future water supplies for waste water reclamation probably will require some additional treatment costs.

Response 17

The costs of supplying additional water to the Delta pool will depend on which supply projects, many of which are authorized by SB 200, are actually constructed. All of the water sources under study as future additions to the State Water Project have different unit costs of new yield, as shown in the following tabulation.

Future Source of Water for State Water Project	Incremental Yield (Acre-Feet/Year)	Unit Cost ($/Acre-Foot)
Peripheral Canal	700,000	100
Cottonwood Creek Project	200,000	200
Thomes-Newville	220,000	245
Los Vaqueros	265,000	325
Enlarged Shasta Reservoir	1,400,000	175

These projects will be subject to additional separate environmental review. The general provisions of all SWP water supply contracts include allowances for temporary and permanent water delivery shortages. The temporary shortages are a function of hydrology and are planned for in the determination of project yield and deliveries. Project user contracts include these shortages and the probable frequency of occurrence. The economics associated with these temporary shortages are included by local users in their agricultural use. These temporary shortages are not planned for M&I users and project operation studies show that M&I users will not be subjected to these deficiencies. This is the case with the North Bay Aqueduct water users. A permanent shortage would affect all SWP users. There is no information available to determine the economic effects of this type of shortage; however, the North Bay Aqueduct maximum entitlement constitutes less than 2 percent of the State Water Project maximum entitlement.

Response 18

More detailed cost information has been developed on both water conservation and waste water reclamation and is included in the Section 1 and in Appendices II and III. No alternative M&I water supply that is not part of the preferred alternative has been eliminated solely on cost considerations. (Also see Response 13.)

Response 19

See Responses 1, 4, 7, 8, 10, 12, 13, 14, 16, 17, and 18.

Response 20

The discussion of population growth and cumulative impacts presented in Section 6.2 and 6.3, respectively, is based on information contained in other sections throughout the Draft ES/EIR (e.g., Section 3.1, Supplemental Water Needs; Section 5.4, Air Resources; Section 5.6, Population; Section 5.7, Land Use; Section 5.8, Public Services and Facilities; Section 6.1.1, Construction Impacts; Section 6.12, Operational Impacts).

Response 21

Based on local General Plans and personal communication with planning staff, Solano County projects a population of 326,000 for 1990. This is somewhat lower than the most recent State Department of Finance estimates of 342,400, on which North Bay Aqueduct water demand calculations are based (see Table 6-2(F)). Based on the 1975 General Plan, Napa County projects a population of 115,000 for the year 2000. The most recent State Department of Finance estimate is 113,200 (see Table 6-2(F)). The latter estimate is an increase of only 14,100 over the present county population. Therefore, maximum demand for the North Bay Aqueduct supply will not be realized until well beyond the year 2000 in Napa County. Policies of the State of California's Urban Strategy, including clustering of development where possible, protecting agricultural lands, and preserving open space, are all policies contained in local general plans in Solano and Napa counties.

Response 22

The discussion of cumulative impacts in Section 6.3 of the draft report is based on information and analysis contained throughout the remainder of the Draft ES/EIR. The projects cited in Section 6.3 are those that are of enough significance to create a potential for substantial cumulative impacts along with the North Bay Aqueduct project. (See Response 1 to comment letter from U. S. Environmental Protection Agency.)

Response 23

The hydrologic modeling analysis conducted as part of the Draft ES/EIR and presented in Appendix F of the draft report used base conditions in the Delta that assumed export of water by the SWP and CVP. Cumulative impacts are discussed in Response 1 to the U. S. Environmental Protection Agency comment letter. (See page F-3 of the Draft ES/EIR.)

Response 24

The cumulative impacts of the CVP, SWP, and other existing and future projects (e.g., SB 200 facilities) were analyzed in Bulletin 76, published by the Department of Water Resources in 1978. This report was incorporated into the Draft ES/EIR by reference. (See Response 1 to comment letter from U. S. Environmental Protection Agency.)

Response 25

The impacts of new supply and delivery facilities to increase the Delta pool will depend on which projects are actually constructed. The specific effects of each of these projects will be determined during their environmental review. The degree of deficiency in dry and critical years would depend on how many additional water supply projects of the SWP are built. The incremental impact of the North B Aqueduct diversion on the degree of deficiency that may be required of present SWP contract users will be minor. (The North Bay Aqueduct maximum annual entitlement represents less than one percent of the total Delta diversions.) (See Response 1 to comment letter from U. S. Environmental Protection Agency and Response 17 to this letter.)

Commenting Entity: Pacific Gas and Electric Company
July 15, 1981

Response 1

The Department will provide Pacific Gas and Electric Company with sufficient advance notice for any engineering work, acquisition of rights of way and permits, materials delivery, and construction work that might be necessary during project development and operation.

Commenting Entity: The Nature Conservancy
July 24, 1981

Response 1

Following review of all comments on the Draft ES/EIR and discussions with local water agency officials, Route 1 has been selected as the preferred aqueduct alignment.

Response 2

Comments noted. The biological sensitivity of Routes 2/2A has been recognized in the Draft ES/EIR (Section 6.1.1.1.15, p. 130).

Commenting Entity: The Nature Conservancy
August 25, 1981

Response 1

Route 1 Modified has been dropped from consideration as a route for the North Bay Aqueduct. (See Response B1 to comment letter from Napa County Flood Control and Water Conservation District.)

Commenting Entity: The California Native Plant Society
State Conservation Coordinator
July 26, 1981

Response 1

Following review of all comments received on the Draft ES/EIR and discussions with local water agency officials, Route 1 has been selected as the preferred North Bay Aqueduct alignment.

Response 2

Sample test borings taken along Route 2 indicate that construction of the aqueduct would probably not affect surrounding vernal pools. Other alignments have not been thoroughly investigated from a geotechnical standpoint (Section 6.1.1.1.8, p. 94). Further test borings and continued monitoring of ground water levels in sensitive vernal pool areas for the selected route has been added to mitigation measures in Section 6.1.1.5. (Section 6.1.1.5.1, pp. 134, 135). Corrective measures are also in Response 3 to this letter.

Response 3

Comment noted. Areas disturbed by construction would be revegetated with native plant species to the maximum extent practicable (Section 6.1.1.5.1, p. 134). (See also Section 3, corrections to page 133, new paragraph 6.1.1.4 and additions to 6.1.1.5.

Commenting Entity: The California Native Plant Society
Sacramento Valley Chapter
August 10, 1981

Response 1

Additional investigation by the Department has resulted in revised information for Chapter 3.0 of the Draft ES/EIR. This investigation confirms the necessity of the North Bay Aqueduct to meet water demands in Solano County before 1990. (See Sections 1 and 3.)

Response 2

Demand for agricultural water in Solano County to the year 2000 will be met through reuse of agricultural irrigation supply, waste water reclamation, and possibly conjunctive use of surface and ground water. Agricultural water demand in Napa County is expected to decline by the year 2000.

Response 3

Hydrologic modeling conducted as part of the Draft ES/EIR and included as Appendix F of the draft report considered the potential impacts of the Peripheral Canal. Because Delta water quality and flow protection provided by the State Water Resources Control Board through Decision 1485 apply with or without the Peripheral Canal, construction of the Canal would not have a significant impact on North Bay Aqueduct water quality. Any changes in the Peripheral Canal or Decision 1485 would require a separate Environmental Impact Report. Additional water quality sampling in Cache Slough near the proposed North Bay Aqueduct intake has shown that removal of the Vacaville Wastewater Treatment Plant discharge upstream of Cache Slough will significantly benefit water quality there. (See Response 3 to letter from the City of Napa, Response 1 to letter from U. S. Environmental Protection Agency, and Response 8 to letter from The Resources Agency of California.)

Response 4

Following review of all comments received on the Draft ES/EIR and discussions with local water agency officials, Route 1 has been selected as the preferred North Bay Aqueduct alignment.

Response 5

Areas disturbed by construction would be revegetated with native plant species to the maximum extent practicable. (See also Section 3, corrections to page 133, new paragraph 6.1.1.4 and additions to 6.1.1.5.)

Commenting Entity: The California Native Plant Society
San Francisco Bay Area Chapter
July 27, 1981

Response 1

Comment noted.

Response 2

See Response 20 and 21 to comment letter from Friends of the River and Response 10 to comment letter from U. S. Environmental Protection Agency. Growth-inducing aspects of the proposed action are discussed in Section 6.2.3, p. 144 of the Draft ES/EIR.

Response 3

Following review of all comments on the Draft ES/EIR and discussions with local water agency officials, Route 1 has been selected as the preferred North Bay Aqueduct alignment. This alignment avoids much of the Jepson Prairie habitat. In the event that Route 2/2A were selected, vernal pools would be protected to the maximum extent practicable. (See discussions in Section 6.1.1.5, p. 133, and Section 6.1.1.5.1, pp. 134-135, of the Draft ES/EIR.)

Response 4

See Response 3.

Response 5

Possible mitigation measures are discussed in Section 6.1.1.6, p. 133, as corrected in Section 3. DWR will restore disturbed areas to natural conditions to the extent possible. (See also Section 3, corrections to page 133, new paragraph 6.1.1.4 and additions to 6.1.1.5.

Response 6

Comments noted.

Commenting Entity: State Senator Jim Nielsen
July 29, 1981

Response 1

The Department of Water Resources considered reasonable and enforceable water conservation programs for Solano County Flood Control and Water Conservation District and Napa County Flood Control and Water Conservation District according to:

° Environmental Documentation Process. The Department of Water Resources received important comments on the Draft ES/EIR pertaining to water conservation. The Department is required by law to respond to these comments in a meaningful manner. This law has been established by the National Environmental Policy Act and the California Environmental Quality Act. In addition, responsible agencies are required to adopt feasible alternatives and mitigation measures that reduce significant impacts. Water conservation is a mitigation measure for possible fishery impacts because it will delay contracted entitlement buildup schedules and correspondingly reduce North Bay Aqueduct diverions.

° Federal Permit Process. A U. S. Army Corps of Engineers permit is required for the North Bay Aqueduct pursuant to the provisions of Section 10 of the Rivers and Harbor Act of 1899 (33 USC 403) and Section 404 of the Clean Water Act (33 USC 1344). This permit process requires consultation with federal agencies, including the Environmental Protection Agency (EPA). This information is described in Chapter 2.0 of the Draft ES/EIR. The EPA's comment on the Draft ES/EIR states "Discharges in conjunction with the proposed action would not comply with the Section 404(b)(1) guidelines if it can be determined that a combination of water supply alternatives evaluated in Section 3 of the Draft ES/EIR is practicable and fulfills the basic purpose of the proposed project." Since water conservation was listed as a water supply alternative in the Draft ES/EIR, it was necessary that a specific conservation plan, as well as specifics on other alternatives, be developed to properly identify the potential of the alternatives to comply with EPA's request.

° Executive Order B-68-80. The Governor of the State of California has directed the Department to prepare a water conservation plan for all State Water Project contractors.

° State Water Resources Management Policy. The State's present policies are listed in a public review draft, "Policies and Goals for California Water Management, the Next 20 Years", Bulletin 4, Department of Water Resources and State Water Resources Control Board, June 1981.

  Policy One states that water resources already developed shall be used to the maximum extent before new sources are developed. Policy Four states that water development plans shall achieve maximum practicable conservation and efficient use of the water of the State and that:

  - Conservation measures shall be reasonable, practicable, and economically achievable. Energy savings and environmental factors will be given strong consideration.

- Actions shall be taken to ensure that water is used in a reasonable manner and to prevent unreasonable use of water, recognizing the unique nature of each water use.

- Current use of water supplies in a particular area shall be examined to determine the extent to which conservation actions can satisfy increasing demand and defer additional water development for that area. Where there are demonstrated opportunities for water management, proposals shall be developed to reflect reasonable and practicable conservation.

- All means shall be explored for implementing water conservation, including additional legislation that will authorize or require local water agencies to mandate water conservation as a condition of new or continued service and to establish pricing measures that encourage water conservation.

Possible water conservation measures for all North Bay Aqueduct contracting agencies have been added to the Final ES/EIR. A general description of these measures is presented in Appendix I. These measures are used in draft urban water conservation plans for Solano and Napa counties, which are included as Appendices II and III of this final report. The measures presented in these draft plans include measures currently implemented in the service areas and new measures suited to the character and needs of the service area. Negotiations in progress between the Department of Water Resources and North Bay Aqueduct contracting agencies are designed to establish conservation programs that will be implemented through enforceable institutional means including goals or specific conservation measures. Such programs will be reasonable, practical, and economically achievable. The draft urban water conservation plans are being reviewed in current negotiations. The Final ES/EIR also presents potential water savings that correspond to specific conservation measures and these savings could be the framework for the goals of a water conservation program. This conservation program will not reduce the maximum annual entitlements of the North Bay Aqueduct.

The finalized conservation plans will satisfy the requirements of the environmental documentation process and the Executive Order. The cost of implementing the possible water conservation measures is outlined in Tables 3-12(F) and 3-16(F). These costs could be reduced by nonproject funding from sources such as the Renewable Resources Investment Fund and funds from the State Water Resources Control Board for projects that qualify for this conservation program. In allocating these nonproject funds, North Bay Aqueduct conservation programs will be given a first priority to the extent that the Department of Water Resources has the authority to determine priorities. State Water Project funds can also be used to finance capital costs associated with these conservation plans.

In addition, contract modifications that provide significant cost savings from extension of annual contracted entitlement buildup schedules for the North Bay Aqueduct water supply are part of the current negotiations for a conservation program. This reduction in project costs is being reviewed to determine extensions due to: (1) demand changes, which differ from contracted estimates, and (2) water savings from implementation of water conservation programs. These changes will delay or extend some of the contracted scheduled annual entitlements and the maximum annual contracted entitlements. This will reduce the SWP Delta Water Charge to each of the contractors by extending

their contract buildup schedule into the future. The SWP Variable Operation, Maintenance, Power, and Replacement component of the Transportation Charges to each contractor will also be reduced due to lesser quantities of water being pumped because of the conservation.

Response 2

In October 1981, the Department's Division of Design and Construction reevaluated the completion schedule for the North Bay Aqueduct with the objective that it be expeditious and feasible. The most prudent schedule would require 45 months after the Notice of Determination is filed in July 1982. The estimated date of completion for the North Bay Aqueduct is May 1986. The 45-month schedule involves a 6-day construction work week and the assumption that the pumping units will be standard single-speed equipment. The Department of Water Resources also evaluated a construction schedule that required extended daily work shifts; however, this would be costly and probably not needed because procurement of the pumps for the North Bay Aqueduct is the critical time constraint.

Commenting Entity: Downey, Brand, Seymour and Rohwer
August 11, 1981

Response 1

Comments concerning site-specific impacts of the aqueduct on the Vassar property are acknowledged.

Response 2

The water quality of North Bay Aqueduct deliveries and the alignment of the aqueduct were comprehensively discussed in the Draft ES/EIR. The factors associated with selection of an alignment are: (1) environmental impacts, (2) design, (3) construction, (4) operation, (5) costs, and (6) public safety. The preferred alternative alignment was selected over other alignments based on these factors. A water quality study of Cache Slough is presented in the Draft ES/EIR. More information on Cache Slough is provided in a *Department of Water Resources publication*, "*Investigation of Cause of Increase* in Chloride Concentrations at the Proposed North Bay Aqueduct Intake at Cache Slough" (July 1981) and in Response 8 to the comment letter from The Resources Agency of California.

Response 3

The Department is willing to work closely with representatives of the Vassar family to alleviate any anticipated problems related to aqueduct construction across the property. Department representatives met with the Vassar family

and their attorney on September 16, 1981, to discuss matters related to alternative Route 1 of the North Bay Aqueduct. The discussion focused on concerns of the Vassar family outlined in this comment letter. Other matters related to the livestock farming operation of Vassar lands were also identified and discussed at this meeting. To the extent possible, the planning and construction process will incorporate the points identified at this meeting with the intent of minimizing any adverse impact to Vassar property. To the extent that such impact cannot be minimized, documented damage to the Vassar family lands from the North Bay Aqueduct will be compensated by the the Department of Water Resources. This policy and the service provided to the Vassar family will be extended to all landowners affected by the North Bay Aqueduct.

Commenting Entity: James Grossi, Jr., Inc., Civil Engineer
July 28, 1981

Response 1

DWR will work with the city of Fairfield and Citation Homes to alleviate any problems created by the North Bay Aqueduct Route 1 alignment. The Department of Water Resources is studying the General Development Plan for the Greenvale planned unit development and will meet with James Grossi and other Citation Home representatives to develop a solution to this problem.

Commenting Entity: Ben W. Allustiarte
August 5, 1981

Response 1

Comment noted. Following review of all comments received on the Draft ES/EIR and discussions with local water agency officials, Route 1 has been selected as the preferred aqueduct alignment.

Response 2

Comment noted. Vernal pools are discussed in Section 5.3.1.2, pp. 64-65, and shown in map segment Figures 6-1 to 6-11.

Response 3

A summary evaluating both the positive and negative environmental effects of each alternative alignment is presented in Section 6.4, pp. 146-155; an overview is presented in Table 6-3. As discussed in the draft report, Route 1 offers a number of significant environmental advantages.

Response 4

Napa County Flood Control and Water Conservation District has stated that Route 2 should be included as a preferred alternative for reasons outlined in a letter from John Mikolojcik to the Department of Water Resources (August 11, 1981). Napa County Flood Control and Water Conservation District and American Canyon County Water District have expressed in their comments a willingness to support the Route 1 alternative if an equitable allocation of costs can be achieved.

Response 5

Comments expressing concern for aqueduct construction and operations costs are noted. These costs are one of many factors considered in selecting a preferred alignment, including the economic costs of secondary distribution.

Response 6

Comment supporting Route 2 or Route 4 as the preferred aqueduct alternative is noted. A meeting was held with Mr. Allustiarte during development of the Draft ES/EIR; his concerns were identified and incorporated into the planning process. Department of Water Resources representatives will meet with all landowners affected by construction of the North Bay Aqueduct to discuss their concerns about this project. The Department will incorporate the concerns of landowners into the planning and construction process with the intent of minimizing adverse impacts where possible. Documented damage to landowners from the North Bay Aqueduct will be compensated by the Department of Water Resources.

Commenting Entity: Richard M. Emigh
August 5, 1981

Response 1

Following review of all impacts, design and construction features, and comments received on the Draft ES/EIR and after discussions with local water agency officials, the Department has selected Route 1 as the preferred aqueduct alignment.

Commenting Entity: Roger W. Souza
August 1, 1981

Response 1

Comment [illegible] placed on the mailing list for distribution [illegible]

Response 2a

Comment [illegible] Route 1.

Response 2b

A reasonable number of bridges for vehicles and livestock would be provided across the canal portions of the aqueduct routes noted if they were selected. However, the Department has selected Route 1 as the preferred aqueduct alignment.

Response 2c

The concrete lining of the open canal of North Bay Aqueduct alignments 2 and 5 cannot be assured to be watertight; however, the amount of leakage would be far less than that required to cause foundation problems. The Department has selected Route 1 as the preferred aqueduct alignment.

Response 2d

Comment noted. The Department will work closely with landowners to alleviate any anticipated problems related to aqueduct construction across their property.

Response 2e

Comment noted. The Department of Water Resources will work with all property owners potentially affected by the selected aqueduct alignment to help alleviate any anticipated problems.

Response 3

Comment noted. Department of Water Resources representatives will meet with all landowners affected by construction of the North Bay Aqueduct to discuss their concerns about this project. The Department will incorporate the concerns of landowners into the planning and construction process with the intent of minimizing adverse impacts. Documented damage to landowners from the North Bay Aqueduct will be compensated by the Department of Water Resources.

Response 4

Following review of all comments on the Draft ES/EIR and discussions with local water agency officials, the Department of Water Resources has selected Route 1 as the preferred aqueduct alignment.

SECTION 3. CORRECTIONS AND ADDITIONS TO THE DRAFT ES/EIR

This section consists of corrections and additions to the Draft ES/EIR made in response to written comments. The corrections and additions are presented in the order of their appearance in the draft report.

There are many corrections and additions for Chapter 3.0, "Water Needs and Alternatives". The changes to Chapter 3.0 are identified here and explained in greater detail in Section 1.

Page x, List of Tables

Tables 3-1 through 3-10 and Table 6-2 have been revised. Tables 3-11 through 3-20 have been added. The updated tables are presented in Section 1. An (F) following a table number shows that the table has been revised for the Final ES/EIR. A list of revised and added tables is included in the Table of Contents of the Final ES/EIR.

Page xvi, Second Complete Paragraph

Replace the first sentence with the following:

> Based on the environmental analysis presented in this report, the North Bay Aqueduct Route 1 alignment plus water conservation program has been selected as the preferred alternative. These conservation programs are for all North Bay Aqueduct contracting agencies and will be implemented through enforceable institutional means including goals or specific conservation measures. Such programs will be reasonable, practical, and economically achievable. The draft urban water conservation plans presented in Appendices II and III are being reviewed in current negotiations and these plans present possible conservation measures for all North Bay Aqueduct contracting agencies. Section 1 and Appendices II and III also include potential water savings that correspond to proposed conservation measures and these savings could be the framework for the goals of a water conservation program. This conservation will provide important mitigation for fishery impacts by extending annual contract entitlement buildup schedules and thereby delaying North Bay Aqueduct annual diversion increases. These conservation programs will not reduce maximum annual contracted entitlements.

Reword the second sentence as follows:

> The major advantages of Route 1, with an intake on Cache Slough, would include possible maintenance coordination with the City of Vallejo's existing intake and avoidance of a potential conflict with the proposed relocation of the City of Vacaville's sewage discharge, relatively low construction and operation costs of secondary water transport systems for

Solano County, avoidance of the Suisun Marsh, and expected lower sensitivity with regard to biological and cultural resources.

Page xvii, Table i

Under impact 9, the low relative magnitude of environmental impact rating for aqueduct Routes 1 and 3 should be changed to a medium rating.

Page 1, Paragraph 1.1.1

Add the following two sentences after the third sentence:

> The Department of Water Resources investigation of M&I demands and current supplies showed that shortages will occur before 1990 if a new source of M&I water is not developed. Chapter 3.0 presents the results of this Department study, which concludes that the total firm supply of all combined alternative supplies will not meet this pre-1990 M&I shortage without the North Bay Aqueduct.

Page 2, paragraph 1.2.3

Reword the last sentence as follows:

> This interim supply was made available by the Solano County Flood Control and Water Conservation District, which agreed to furnish a portion of its available water supply through the Solano Project facilities originating at Lake Berryessa.

Page 13, Paragraph 3.0.1

Reword the third sentence as follows:

> Tables 3-1(F), 3-2(F), and 3-4(F) present a summary evaluation of water supply alternatives.

Page 13, Paragraph 3.0.2

Add the following sentence after the first sentence:

> The projected demand was adjusted for water savings shown by specific urban water conservation measures developed for the North Bay Aqueduct contracting agencies as part of this investigation. These conservation measures do not reduce contracted maximum entitlement deliveries.

Page 13, Section 3.1

Delete the footnote following the section, Supplemental Water Needs, and substitute the following:

The new water demand values were computed using: (1) new State Department of Finance E-150 1980 census information; (2) updated per capita use rates, based on more recent water use information; and (3) new water savings resulting from urban water conservation. The new M&I demand values were computed with and without urban conservation measures. (See Section 1, under Urban Water Conservation and Supplemental M&I Needs.)

Page 13, Section 3.1

Reword the first two sentences as follows:

Municipal and industrial demand for water is expected to exceed supply in Solano County before 1990, as Table 3-3(F) indicates. By 2000, significant shortages will be evident in both counties.

Page 14, Table 3-1, Water Supply Evaluation Summary

Delete this table and substitute Tables 3-1(F), 3-2(F), and 3-4(F).

Page 15, Table 3-2, Future Demand and Supply for Municipal and Industrial Water in Solano and Napa Counties.

Delete this table and substitute Table 3-3(F).

Page 15, Paragraph 3.2.1.1.3

Replace the third sentence with the following two sentences:

Napa County is currently receiving an interim supply of 7,500 acre-feet per year from Lake Berryessa. The North Bay Aqueduct project will replace this interim supply and provide an additional 17,500 acre-feet per year at maximum delivery to meet the 25,000 acre-foot per year contracted entitlement.

Page 16, paragraph 3.2.2.2.1

Delete the second through fifth sentences and substitute the following:

The Department of Water Resources has evaluated the safe yield of ground water in Solano County using 10 years of historical records /5/. The safe yield of ground water for Solano County was computed using historical records from 1965-75. During this period, the local precipitation was average and the ground water levels remained fairly constant. This suggested that recharge and withdrawals were equal and that the average annual pumping was equivalent to the safe yield. This computed safe yield value was 131,700 acre-feet per year. The current ground water pumpage was determined to approximate the safe yield. Therefore, no

additional supply is available from ground water supply development. (See also Section 1, under Ground Water Supply Development.)

Page 16, paragraph 3.2.2.2.2

Revise the second sentence to read:

> Ground water is used primarily during the summer months when water demand is high.

Page 17, paragraph 3.2.2.2.5

Reword the first sentence as follows:

> Based on a recent investigation by the Department of Water Resources, it has been estimated that the maximum potential use of ground water in conjunction with surface supplies (e.g., the Solano Project) to supplement North Bay Aqueduct M&I deliveries is 5,800 acre-feet per year in 1990 and 2,300 acre-feet per year in 2000. /9/ The investigation used surface water supplies that were defined by historical data that described operation of Lake Berryessa for the period from 1906 to 1975. This data was taken from a USBR operation study of Lake Berryessa. (See Section 1, under Conjunctive Use of Surface and Ground Water.)

Page 17, paragraph 3.2.2.2.6

Delete first and second sentences.

Page 17, paragraph 3.2.2.2.7

Reword the fifth sentence as follows:

> Between 1966-75, ground water pumpage, primarily for agricultural irrigation, was estimated at 10,500 acre-feet annually, resulting in a net overdraft of about 600 acre-feet per year. /11/

Page 17, paragraph 3.2.2.2.8

Delete the paragraph and substitute the following:

> The Department of Water Resources' Water Action Plan for the Southwest Sacramento Valley Service Area estimates that the safe yield of ground water in Napa County is equal to the present average annual pumpage, about 10,500 acre-feet and no additional ground water development is possible. The supplemental M&I requirements for Napa County are projected at 2,800 acre-feet per year by the year 2000 (this assumes conservation measures). Since current ground water development estimates in Napa County show maximum use of safe ground water yields, further devel-

opment of ground water cannot be considered as an alternative M&I water supply for the North Bay Aqueduct.

Page 18, paragraph 3.2.2.3.3

Delete first two sentences and substitute the following:

> The potential yield of the Solano Project reanalysis as determined by the U. S. Bureau of Reclamation is 13,000 acre-feet annually /1/. However, the Solano County Flood Control and Water Conservation District has stated that the reanalysis concept of operation will not satisfy their water use needs because their existing contracts with member units now have a total average year use higher than the present firm yield of the Solano Project. This makes it mandatory that they accept a deficiency in critical water supply years independent of the reanalysis. This mandatory deficiency is about 15,000 acre-feet /16/ and is expected to exceed the potential yield from the reanalysis. For this reason, such a supply was considered to be unavailable as a substitute for North Bay Aqueduct supplies. (See also Section 1, under Solano Project Reanalysis.)

Page 19, paragraph 3.2.2.4.3

Replace the last sentence with the following:

> High cost, energy requirements, and the unsuitability of the diversion location at Suisun Slough make this supply unlikely. (See also Section 1, under Desalination of Suisun Slough.)

Page 19, paragraph 3.2.2.5.2

Replace the second sentence with the following:

> The U. S. Bureau of Reclamation has completed a concluding report on this project and found that this water supply is highly unlikely in the near future because of a general lack of support. (See Section 1, under West Sacramento Valley Canal, and Section 2, comment letter from the U. S. Department of the Interior.

Page 19, Section 3.2.3.1

The information presented in paragraphs 3.2.3.1.1 through 3.2.3.1.21 (pages 19-29), including Table 3-3 through Table 3-10, has been revised as part of further investigation by the Department. This updated information is summarized in Tables 3-7(F) through 3-18(F). The previous discussion on water conservation in the Draft ES/EIR provided the framework for development of draft urban water conservation plans for both Solano and Napa counties. A detailed discussion of these plans is presented in Section 1. A general description of all the possible measures used for these plans is in Appendix I. Plans and supporting information are attached as Appendices II and III. The draft urban water conservation plans incorporated measures

currently implemented in the North Bay Aqueduct service area and added new measures that are best suited to the character and needs of the area. These plans include measures for municipal and industrial users. These plans were used to compute annual M&I demand reductions for the years 1990 and 2000, as shown in Table 3-3(F). The preferred alternative for the Final ES/EIR includes conservation programs to assure implementation of urban water conservation. The programs will be implemented through enforceable institutional means and will include goals or specific conservation measures. Such programs will be reasonable, practical, and economically achievable. Negotiations are in progress between the Department of Water Resources and North Bay Aqueduct contracting agencies to finalize these programs. The programs will not reduce the maximum annual contracted entitlements for the North Bay Aqueduct. The plans can extend the existing contracted entitlement buildup schedules and therefore delay annual North Bay Aqueduct diversion increases. This delay in need provides important fishery mitigation.

Page 30, paragraph 3.2.3.1.27

Correct the sixth sentence as follows:

> On the average, about 14,000 acre-feet /2/ of the total 37,000 acre-feet of drainage water in both districts is not reused during the irrigation season.

Delete the eighth sentence.

Correct the ninth sentence as follows:

> Because an increase of 21,600 acre-feet /2/ in agricultural supplemental applied water requirements between 1980 and 2000 is projected (assuming no increase in the prime water supply), the 14,000 acre-foot /2/ potential will be required to meet agricultural demands. The adjustment of agricultural supplemental requirements due to reuse of drainage water supplies is shown in Table 3-6(F). (See also Section 1, under Conjunctive Use of Surface and Ground Water.)

Add the following sentence after the ninth sentence of this paragraph:

> As illustrated in Table 3-6(F), the adjusted agricultural supplemental water requirements for the year 2000 will be 7,600 acre-feet.

Page 31, paragraph 3.2.3.1.30

Delete the fourth sentence and substitute the following:

> In consideration of these factors, the Department has prepared comprehensive draft urban conservation plans for both Solano and Napa counties (see Appendices II and III). The preferred alternative has been modified to reflect implementation of reasonable and enforceable conservation programs.

Page 31, Section 3.2.3.2

Add the following paragraphs:

The Department evaluation of waste water reclamation and projections of supplies from reclamation was done in accordance with Policy 5 of the "Policies and Goals for California Water Management". This policy states: Water shall be reclaimed and reused to the maximum extent feasible." The policy further states that the State shall encourage and consider or recommend for funding reclamation projects that meet the following conditions and that do not adversely affect vested water rights, unreasonably impair instream beneficial uses, or place an unreasonable burden on present water supply systems:

° Beneficial use of waste water that would otherwise be discharged to marine or brackish receiving water or evaporation ponds.

° Reclaimed water to replace or supplement fresh water or better quality water.

° Reclaimed water to preserve, restore, or enhance instream beneficial uses that include but are not limited to fish, wildlife, recreation, and esthetics associated with any surface water body or wetlands.

The Department is also investigating reclamation management for all State Water Project service contractors in accordance with the Governor's Executive Order B-68-80, issued July 1980.

Page 34, paragraph 3.2.3.2.9

Correct the second sentence as follows:

Solano Irrigation District would give Fairfield 1/2 to 2/3 gallons of fresh water from the Solano Project for every gallon of treated waste water received at Dally, and Fairfield would release back to the State Water Project an amount of its North Bay Aqueduct entitlement equal to the amount of additional fresh water it obtains from Solano Irrigation District.

Page 34, paragraph 3.2.3.2.10

Delete this paragraph and substitute the following:

Implementation of waste water reclamation projects is complex and requires consideration of many factors. The Department of Water Resources recently reviewed preliminary cost data for the proposed Dally Reclamation Project in Solano County, which would have involved delivery of waste water from the Fairfield Suisun Wastewater Treatment Plant for agricultural irrigation in the Dally area of the Solano Irrigation District northeast of Fairfield in exchange for Solano Project water. The unit cost of water would be about two times the marginal cost of new supplies being considered for the State Water Project. For the State

Water Project to be involved in this project, the local waste treatment agencies would have to finance more than half the cost, and this would not be feasible. The following are the most significant reasons for the estimated high cost of water from the Dally Reclamation Project.

- ° The distance the reclaimed water would have to be transported from the Fairfield Suisun Wastewater Treatment Plant for agricultural use compared to the relatively small amount of water reclaimed.

- ° The required tradeoff of reclaimed waste water for fresh water at 2 to 1 or 1-1/2 to 1. This ratio was considered because of the greater marketing advantages and lower operations cost of fresh water.

- ° The seasonal use of the reclaimed water. The Dally agricultural area needs irrigation only about five months of the year, resulting in low usage of the pipeline.

The same kinds of consideration would apply for a number of similar applications in other portions of Solano and Napa counties. Further, the Dally Project appeared to be the most favorable waste water reuse opportunity for the Fairfield Suisun Wastewater Treatment Plant, and the sewage production from that plant in the year 2020 will be roughly 20 percent of the total waste water from cities in the North Bay Aqueduct service area.

Page 35, Section 3.2.3.2

Add the following paragraph 3.2.3.2.14 to this section:

3.2.3.2.14. The portion of present and projected additional waste water supplies that could potentially be reclaimed is shown in Table 3-5(F). These values show a total maximum potential of 4,400 acre-feet per year of additional M&I supplies for Solano and Napa counties available from reuse in the year 2000. However, no contractual arrangements for these future reuse supplies have been initiated. (See Section 1, under Waste Water Reclamation.)

Page 35, Section 3.2.4

This information has been updated. (See Section 1.)

Page 36, Section 3.2.4

Delete paragraph 3.2.4.9. This information has been updated. (Refer to Section 1, under Waste Water Reclamation.)

Page 37, paragraph 3.4.1

Replace the paragraph as follows:

> The North Bay Aqueduct plus water conservation programs is selected by the Department as the preferred water supply alternative. The North Bay Aqueduct is needed to assure satisfaction of future M&I demand for Solano and Napa counties because the total firm supply of all combined alternatives without the North Bay Aqueduct will not meet future supplemental water requirements. The water conservation programs of the preferred alternative will be reasonable, practical, and economically achievable. These programs will be implemented through enforceable institutional means, including goals or specific conservation measures. The draft urban water conservation plans presented in Appendices II and III outline possible conservation measures and are being reviewed in current negotiations. Appendices II and III also include potential water savings that correspond to proposed conservation measures and these savings could be the framework for the goals of a water conservation program. These programs will extend contracted entitlement buildup schedules, but will not reduce the maximum annual contract entitlements.

Page 38, References Cited

Change Reference 2 to read:

> Department of Water Resources, October 6, 1980, Water Action Plan for the Southwest Sacramento Valley Service Area.

Change Reference 9 to read:

> Department of Water Resources, January 1982, a memorandum report describing the interpretation of an operation study of Lake Berryessa by USBR to estimate potential for conjunctive use of surface and ground water in Solano County.

Change References 5, 11, and 13 to read:

> Department of Water Resources, October 6, 1980, Op cit.

Page 40, References Cited

Change Reference 46 to read:

> Department of Water Resources, October 6, 1980, Water Action Plan for the Southwest Sacramento Valley Service Area.

Page 47, Section 4.3

Delete paragraph 4.3.3 and add the following paragraphs after paragraph 4.3.2:

4.3.3. The 30 contractors for State Water Project (SWP) water pay all costs incurred in developing and delivering the water supply. The charges that the contractors pay to defray all costs of the SWP are divided into two major groups, the Delta Water Charge and the Transportation Charge.

4.3.4 The Delta Water Charge is essentially a charge to repay the reimbursable costs of those features of the SWP that develop a water supply and conserve it for use by the contractors. This is an average (melded) cost of all facilities that develop supply. The annual Delta water costs for the North Bay Aqueduct (NBA) contracted water over the period of entitlement buildup are estimated to range from $1,000,000 in 1986 to $2,700,000 at time of full entitlement. Delta Water Rates (cost per acre-foot) are estimated in Bulletin 132-81 to be $30 in 1982, increase to $50 by 1990, and then remain constant to 2035. The incremental (marginal) cost to develop new conservation facilities is $200 per acre-foot, as cited on page 30 of DWR Bulletin 76-81.

4.3.5 The Transportation Charge is paid by all SWP contractors to repay transportation facilities used to deliver their water supply. The Transportation Charge is divided into three parts: the capital cost component, the minimum operations maintenance power and replacement component, and the variable operations maintenance power and replacement component. The Transportation Charge is an incremental (marginal) cost. The annual transportation costs for the North Bay Aqueduct over the period of entitlement buildup are estimated to range from $3,200,000 in 1986 to $4,700,000 at full entitlement. Transportation costs are estimated to range from 70 percent in 1986 to 40 percent at full entitlement of total NBA charges. Interest on bond indebtedness and on construction funds is included in the transportation charge.

4.3.6 Based on DWR Bulletin 132-81 existing Table A contract entitlement amounts, the total cost per acre-foot of water is listed below:

Solano County Flood Control and Water Conservation District:

1986	$168/acre-foot	2000	$103/acre-foot

Napa County Flood Control and Water Conservation District:

1986	$424/acre-foot	2000	$257/acre-foot

4.3.7 Modifications of existing State Water Project water supply contracts for the North Bay Aqueduct can reduce present water charges. Estimates of cost savings for extensions of contracted entitlement build-up schedules for the North Bay Aqueduct are being reviewed in current negotiations for the urban water conservation programs. These programs are part of the preferred alternative. Schedules of contracted annual entitlement deliveries are being reviewed to determine possible changes due to: (1) demand changes that differ from contracted estimates, and (2) water savings from the water conservation programs. These changes

will delay some of the contracted buildup schedules of annual entitlements. This will reduce the SWP Delta Water Charge to each of the contractors. In addition, the SWP Variable Operation, Maintenance, Power, and Replacement component of the Transportation Charges to each contractor will be reduced due to lesser quantities of water being pumped with the water conservation plans in effect. These adjustments will reduce the cost of North Bay Aqueduct water to the customer. Preliminary estimates done for Napa County Flood Control and Water Conservation District show that their water costs can be reduced by about $65/acre-foot in 1986 and $45/acre-foot in 2000 due to extension of contract entitlement buildup schedules (Table A).

4.3.8 The cost of implementing possible water conservation measures is outlined in Tables 3-12(F) and 3-16(F). These costs could be reduced by nonproject funding from sources such as the Renewable Resources Investment Fund and funds from the State Water Resources Control Board for projects that qualify for these funds. In allocating these nonproject funds, North Bay Aqueduct conservation programs will be given a first priority to the extent that the Department of Water Resources has the authority to determine priorities. Project funds could also be used to finance parts of the programs. The combination of nonproject funding sources with annual savings due to entitlement extensions can significantly offset the costs associated with implementation of the conservation programs.

Page 47, Section 4.4.1

Add the following paragraphs 4.4.1.1 and 4.4.1.2 to this section:

4.4.1.1 The Department of Water Resources and the Department of Transportation are coordinating planning to avoid conflicts between aqueduct construction and completion of the Fairfield State Highway 12 bypass and Interstate 80 interchange. Representatives of Department of Transportation, the city of Fairfield, and DWR met on January 15, 1982, to review the latest plans for the bypass and interchange. DWR met again with the Department of Transportation on February 4, 1982, to discuss this matter. Some identified alternative locations of the interchange could interfere with a section of the North Bay Aqueduct Route 1 alignment and Phase II of the city of Fairfield's proposed linear park system. If it were necessary to compensate for this interchange, a section of the aqueduct and linear park system alignment along the existing railroad right of way from a location 2,000 feet east of Abernathy Road westerly to Russell Road would have to be moved up to 600 feet in a northerly direction. The aqueduct would require 80 feet of construction right of way through some orchards and vineyards. The permanent right of way will be 40 feet wide. About 370 trees and 800 feet of vineyard would be affected. In addition, the existing right of way for Phase II of Fairfield's linear park system may not be adequate to provide the necessary construction requirement for the North Bay Aqueduct for a distance of about 2,000 feet along the existing railroad right of way, extending westward from Russell Road. If the North Bay Aqueduct construction requires some additional right of way, this could affect about 200 to 400 additional orchard trees.

4.4.1.2 Local subdivision planning near the North Cordelia Forebay will require some changes in the forebay location and the section of the aqueduct 36-inch pipeline that connects the forebay to the Cordelia surge tank. This surge tank is the beginning of the Phase I facilities of the North Bay Aqueduct. The planned relocation will move the forebay and section of aqueduct about 2,000 to 3,000 feet in an easterly direction. The section of pipeline will be aligned to correspond to street systems in the proposed subdivisions. This section is about 8,400-feet long. The relocated forebay will displace land that is probably similar to the land type displaced by the North Forebay location described in the Draft ES/EIR.

Cultural resources in the area of the planned relocation of the forebay and 36-inch aqueduct section have been investigated. The findings of the investigation are listed in Appendix E of the Draft ES/EIR and in Appendix IV of the Final ES/EIR. Important sites in this area include:

° CA-Sol-268, a prehistoric archaeological site located within the alignment corridor section between Interstate Highway 80 and the Cordelia surge tank. A detailed investigation of this site conducted for the Final ES/EIR concluded that these archaeological resources are no longer a critical resource issue. The State Historic Preservation Office in Sacramento agreed with this finding.

° Rock Fence Segments, historic features located within the alignment corridor section between Interstate Highway 80 and the Cordelia surge tank. The segment of the rock fence that transects this corridor likely dates from the late 1800s, when numerous such fences were constructed to mark boundary lines and serve as stock fences. This feature will be avoided by the planned relocation of the North Forebay and 36-inch aqueduct line.

° Unnamed Historic Ranch Cluster, on Green Valley Road. This site will be avoided by the planned relocation.

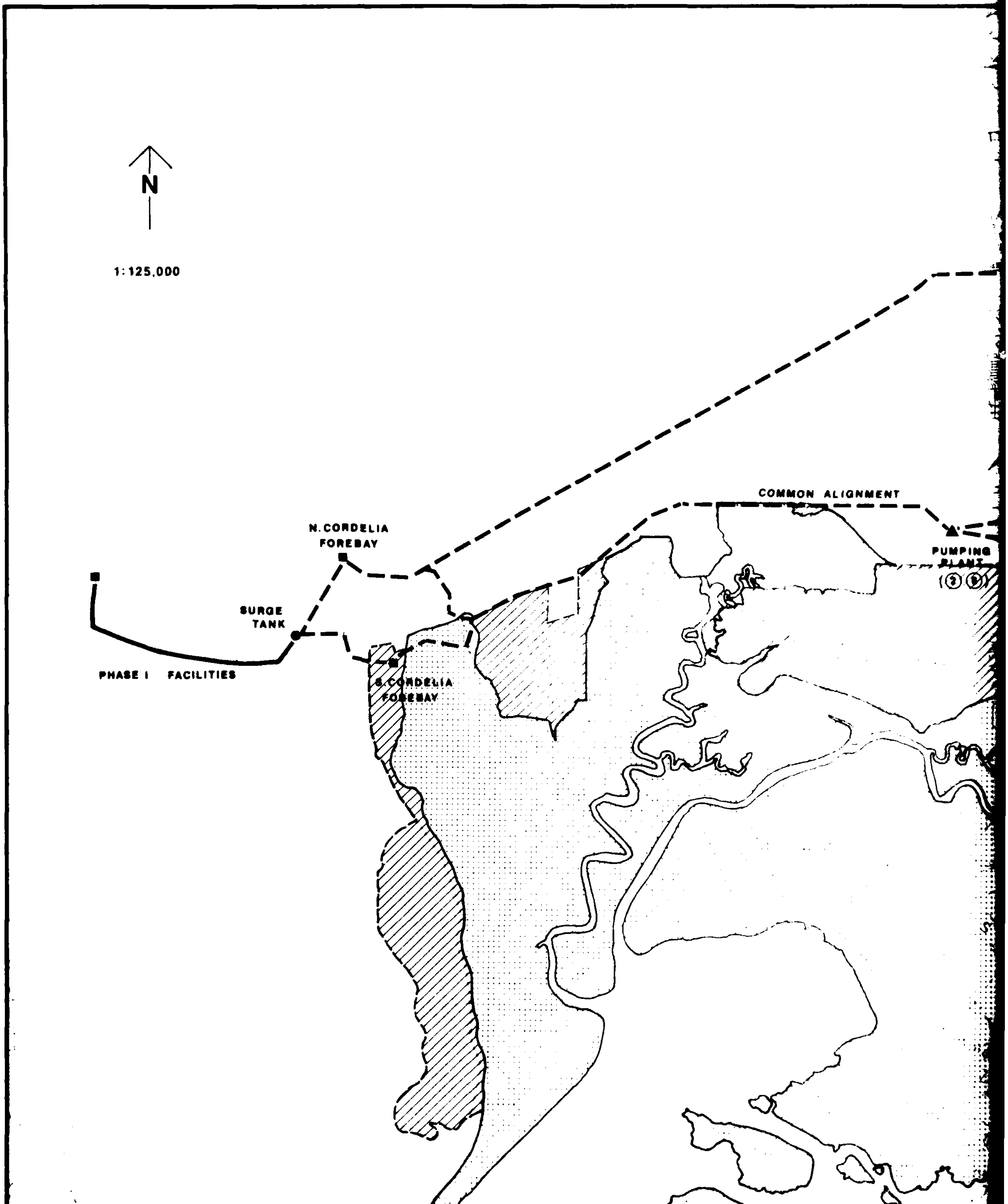
Page 67, Figure 5-4

Figure 5-4 has been modified to more clearly indicate the boundaries of the primary management zone in the Suisun Marsh.

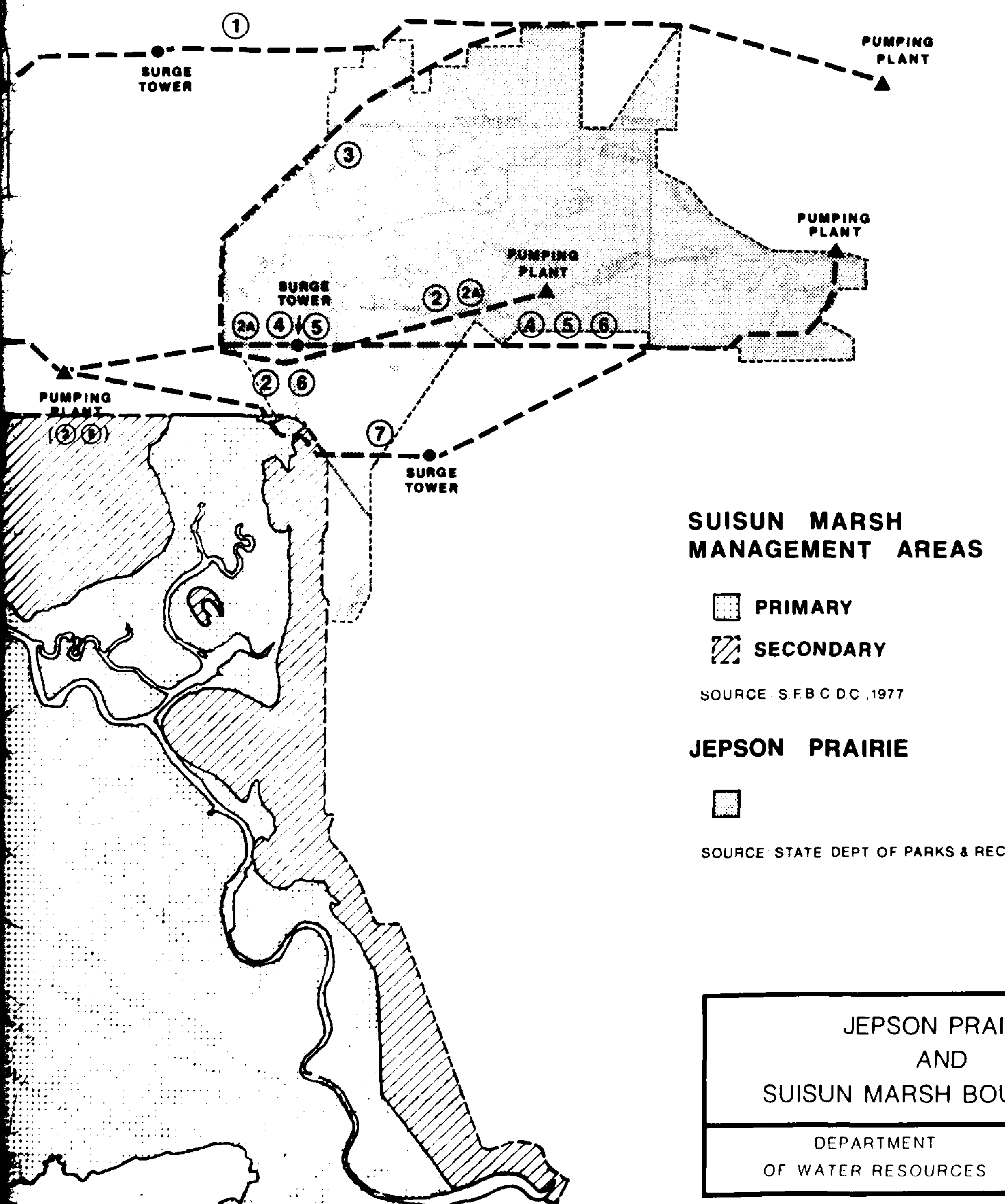
Page 69, paragraph 5.3.2.2.4

Replace the last sentence in this paragraph with the following:

> Recent evidence indicates that the importance of Cache and Lindsey Sloughs with respect to fisheries is similar. Recently published research performed by Ecological Analysts for Pacific Gas and Electric Company ("Pittsburg Power Plant Cooling Water Intake Structure 316(B) Demonstration", November 1981) shows that migrating juvenile striped bass are widespread in Delta sloughs and channels rather than being confined to the main channels. (See Response 1 to comment letter by National Marine Fisheries Service.)



Prepared by Madrone Associates



SUISUN MARSH MANAGEMENT AREAS

- PRIMARY
- SECONDARY

SOURCE: S.F.B.C.D.C.,1977

JEPSON PRAIRIE

SOURCE: STATE DEPT OF PARKS & REC

JEPSON PRAIRIE
AND
SUISUN MARSH BOUNDARIES

DEPARTMENT OF WATER RESOURCES

FIG. 5-4

Page 70, paragraph 5.3.2.3.4

Change the third sentence to read:

> This beetle may be found at the edges of vernal pools or in moist cracks in the earth, which are numerous in Jepson Prairie.

Page 70, paragraph 5.4.2.2

Delete the first sentence and substitute the following:

> The portion of Solano County in the Sacramento Valley Air Basin is a nonattainment area only for ozone.

Page 71, paragraph 5.4.3.1

Reword the first sentence as follows:

> Air quality plans for the Bay Area and Sacramento Valley basins have been written by the Association of Bay Area Governments (ABAG) and the Sacramento Area Council of Governments (SACOG), respectively.

Delete the last sentence and substitute the following:

> With respect to hydrocarbon emissions from mobile sources, the 1979 Bay Area Air Quality Plan: (1) locally commits to a motor vehicle inspection and maintenance program (although the legal authority for such a program has not been provided by the State Legislature); (2) assumes continued implementation of the California Motor Vehicle Control Program (emission standards for new cars sold in California); and (3) commits to implementation of five classes of transportation control measures to reduce the amount of vehicle miles traveled. /40/

Page 71, paragraph 5.4.3.2

Delete the second sentence and substitute the following:

> Carbon monoxide control strategies in the Bay Area basin include reducing carbon monoxide levels in motor vehicle exhaust through continued implementation of the California Motor Vehicle Control Program, motor vehicle inspection and maintenance, and transportation control measures to reduce vehicle miles traveled.

Page 77, paragraph 5.8.5.1

Change the reference to the Vacaville Sanitary Service in the second sentence to Vacaville Sanitation Service.

Page 78, paragraph 5.8.5.3

Change the reference to the Vacaville Sanitary Service in the second sentence to Vacaville Sanitation Service.

Page 89, References Cited

Change Reference 50 to indicate that "Projections 79" was a draft document.

Page 90, References Cited

Change Reference 84 to read Vacaville Sanitation Service.

Page 129, paragraph 6.1.1.1.10

Delete the last sentence. More recent information indicates that Lindsey Slough and Cache Slough would likely be equally sensitive with regard to impacts on fisheries. See Section 2, response to comment 1, National Marine Fisheries Service letter.

Page 130, paragraph 6.1.1.1.14

Change Reference /5/ following the second-to-last sentence to Reference /6/.

Page 131, paragraph 6.1.1.2.5

Change Reference /8/ to Reference /7/ and adjust References /9/ through /18/ accordingly.

Page 131, section 6.1.1.2

Add the following paragraph:

> 6.1.1.2.5.1. The Route 1 alignment will require replacement of a major portion of Phase I of Fairfield linear park system. This replacement will cost about $1.1 million. During construction of the North Bay Aqueduct, the park system will be out of use for several months before replacement, which will cause a social impact. The Department of Water Resources is working with the City of Fairfield to arrange necessary coordination to avoid any disruption to Phase II of their linear park system.

Page 133, section 6.1.1.4

Add the following paragraph:

6.1.1.4.3 The Department of Water Resources will provide mitigation for disruption of use of Phase I of Fairfield's linear park system by construction activities providing an extension of the park system. In addition, the Department will do the following:

- ° Construction activity in stream areas will employ special erosion control measures to lessen the possibility of increased sedimentation in the streams, such as covering storage piles of material, controlling truck movements near creeks to avoid spilling material into the streams, and revegetating graded creek slopes before winter rainfalls.
- ° Revegetate construction-disturbed areas overlying pipelines or along canal banks as quickly as possible to reduce erosion potential and dust generation. Native vegetation will be employed to the maximum extent possible.
- ° Determine the temporary and permanent impacts of extensive dewatering on the ground water levels. If ground subsidence occurs during construction, protect any existing structures from damage due to dewatering. Solano County and Suisun City could require the contractor to post a bond for protection of existing structures.
- ° Continue to monitor ground water levels in the vernal pool area to be sure the pools would not be adversely affected by a Route 2/2A alignment.

Page 133, section 6.1.1.5

Add the following to the end of paragraph 6.1.1.5.1:

The Department will do all the measures that apply to the selected alignment to the extent possible.

Add the following mitigation measures:

- ° Correct or compensate for disturbances to subsurface irrigation and drainage systems.
- ° Further test borings and continued monitoring of ground water levels necessary for sensitive vernal pool areas will be conducted during construction of the selected route.
- ° Seek expert guidance as to revegetation of disturbed areas with native plant species.
- ° To the extent possible, excavated soils will be replaced, compacted, and consolidated to natural (in place) conditions.

- Before construction, provide information or plans regarding soil replacement and revegetation.

Page 136, paragraph 6.1.2.3.1

Change the second sentence to read:

> Diversions made during periods of controlled flow will be replaced by releases from project storage to maintain Delta outflows according to the protective criteria set by Water Rights Decision 1485. During periods of uncontrolled flows, the North Bay Aqueduct diversions will come from flows that exceed the water rights standards.

Page 138, paragraph 6.1.2.4.3

Delete the second sentence. More recent information indicates that Lindsey Slough and Cache Slough would likely be equally sensitive with regard to impacts on fisheries. (See also Response 1 to comment letter by National Marine Fisheries Service.)

Page 139, paragraph 6.1.2.4.6

Delete the last sentence and substitute the following:

> In the event of an open canal, some waterfowl could be expected to make use of this additional water habitat. However, the concrete lining in the canal would not generally constitute favorable wildlife habitat.

Page 142, paragraph 6.1.2.9.1

Replace the last two sentences with the following:

> Project reservoir storage releases are made during periods of control flow conditions to supply (1) project diversion flows, (2) downstream and Delta consumptive water use, and (3) Delta protective outflow requirements. All North Bay Aqueduct diversions will be replaced by project storage during controlled flow conditions. Control flow conditions exist when project releases are needed to meet minimum Delta protective flow needs. Uncontrolled flow conditions exist when natural Delta inflow exceeds protective Delta flow requirements. The portion of project storage releases needed to meet present protective outflow needs are set by Decision 1485 by the State Water Resources Control Board, which defines the water rights for the State Water Project. Protective Delta flows take priority over State Water Project diversions. The Department of Water Resources is working with the Department of Fish and Game to finalize a Two-Agency Fish and Wildlife Agreement that will provide additional outflow protection with the objective of restoring fish populations to historical levels. This additional outflow will be proportionately allocated to the North Bay Aqueduct costs through the Delta Water Charge component of the annual charges. (See Section 2,

Response 1 to comment letter from U. S. Environmental Protection Agency, and Section 3, correction to page 47.)

Page 142, paragraph 6.1.2.9.2

Add the following after the last sentence:

The Department of Water Resources will also provide important mitigation for fishery impacts at the North Bay Aqueduct diversion by implementing reasonable and enforceable urban water conservation programs for North Bay Aqueduct water users. The possible conservation measures for these programs are described in Appendix I and the draft plans are in Appendices II and III. Negotiations are now in progress to finalize these programs. The measures outlined in these plans will extend contract entitlement buildup schedules and correspondingly delay the North Bay Aqueduct annual diversion increases.

Page 142, section 6.1.2.9

Add the following paragraph:

6.1.2.9.4 The Department of Water Resources will commit to studies that will provide more information in connection with impacts to fish eggs and larvae caused by North Bay Aqueduct diversions. Current information and discussions with the Department of Fish and Game indicate that these impacts would be minor. If the future studies determine that mitigation is required, the Department will provide the mitigation needed to offset the impact. Possible methods to mitigate impacts to fish eggs and larvae are: (1) limitation of North Bay Aqueduct diversions between April and June, (2) additional modification of the planned Two-Agency Fish Agreement to increase fish populations to adjust for study finding, (3) additional modification of State Water Project storage and export operations to provide benefits for fish, and (4) project funding allocations to reduce Delta system egg and larvae losses from nonproject activities.

Page 142, Section 6.1.2.9

Add the following paragraph:

6.1.2.9.5 Continue to conduct water quality studies (i.e., inorganic and organic chemicals) in the vicinity of the intake location to protect the suitability of the water as an M&I source. Organic chemical levels and sediment loadings will be of particular concern.

Page 142, Section 6.1.2.10

Add the following sentence to the end of the first paragraph:

> To the extent these are possible and apply to the selected alternative, they will be done.

Delete the last paragraph.

Page 142, footnote

Correct the footnote to read:

> The Department of Water Resources has recently completed a one-year water quality sampling program in several locations of Cache and Lindsey Sloughs /18/. The findings of this study are presented in the report, "Investigation of Cause of Increase in Chloride Concentration at Proposed North Bay Aqueduct Intake in Cache Slough", Department of Water Resources, Central District, July 1981. (See also Section 2, response 8 to comment letter from The Resources Agency of California.)

Page 144, paragraph 6.2.3.2

Change the second sentence to read:

> At the updated per capita average use rate used for the new information in Section 1, under Urban Water Conservation and Supplemental M&I Needs (0.233 acre-foot per person per year in Solano County, assuming no water conservation measures and including industrial consumption), the additional 42,000 acre-feet of water could support a population increase of about 180,000, which is substantially below the increase projected for the period 1980 to 2010. Per capita average use rate is found by multiplying the per capita use rates by the 1980 population of each area and dividing by the total 1980 population of the county.

Page 144, paragraph 6.2.3.3

Delete the second sentence and substitute the following:

> At the updated per capita average use rate used for the new information in Section 1, under Urban Water Conservation and Supplemental M&I Needs (0.233 acre-feet per person per year in Napa County, assuming no water conservation measures and including industrial consumption), the new water supply provided by the North Bay Aqueduct (17,500 ac-ft) indicates that the additional water could support a population increase of about 74,500. This is substantially in excess of the increase projected for the period 1980 to 2010. Consequently, full use of Napa County's Maximum Annual Entitlement from the North Bay Aqueduct may occur after the year 2010. On the other hand, growth in excess of that presently projected may occur. Per capita average use rate is found by multiplying the per

capita use rates by the 1980 population of each area and dividing by the total 1980 population of the county.

Page 145, Table 6-2

Table 6-2 of the Draft ES/EIR has been updated to reflect the most recent State Department of Finance E-150-series population projections for Napa and Solano counties and has been designated Table 6-2(F).

Page 146, paragraph 6.3.4

Change parenthetical sentence at end of paragraph to read:

(See Sections 6.1.1.2 and 6.1.1.4.)

Page 146, paragraph 6.2.3.5

Replace the first sentence with the following:

It should be noted that operation of the North Bay Aqueduct to meet the contracted maximum annual entitlement of 67,000 acre-feet will have monthly diversions that vary from about 50 cfs in the winter to 115 cfs in the summer. It would be physically possible under a hypothetical mode of operation for the aqueduct to be operated at the maximum monthly rate on a continuous basis to produce a theoretical maximum water supply of about 76,000 acre-feet per year. This mode of operation would not be compatible with existing SWP water service contracts for the North Bay Aqueduct.

Add the following paragraph:

6.3.5.1 There are several operational mitigation measures for the North Bay Aqueduct that will offset cumulative impacts. The Department will commit to:

° Future coordinated planning with Department of Fish and Game and possibly U. S. Bureau of Reclamation to operate project reservoir storage, export rates, and daily offpeak and onpeak export pumping to meet fishery improvement goals. These goals are in connection with the Two-Agency Fish and Wildlife Agreement and current planning for the additional proposed pumping units for the Harvey O. Banks Delta Pumping Plant. (See correction for page 142, paragraph 6.1.2.9.2).

° Urban water conservation programs for Solano and Napa counties to reduce diversions by delaying annual entitlement buildup schedules (see correction for page 142, paragraph 6.1.2.9.2).

° Protective fish screens at the intake.

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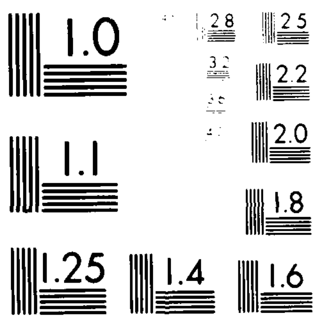

MICROCOPY RESOLUTION TEST CHART

Table 6-2(F)

REVISED E-150 POPULATION PROJECTIONS 1/
FOR SOLANO AND NAPA COUNTIES
ADJUSTED FOR 1980 CENSUS

	1980	1990	2000	2010
Solano County				
Total	235,300	342,400	428,700	514,800
Napa County				
Total	99,100	106,300	113,200	119,200
Both Counties				
Total	344,400	448,700	541,900	634,000

1/ Source: State Department of Finance

- Studies to determine specific information on the numbers of fish eggs and larvae that will be affected by the aqueduct diversions. Current information and discussions with the Department of Fish and Game indicate that this impact will be minor. (See Section 2, response 2 to comment letter from National Marine Fisheries Service.)

- Additional mitigation action for fish eggs and larvae if future studies show the need for additional action. The Department of Water Resources will provide mitigation for possible impacts to fish eggs and larvae at the North Bay Aqueduct diversion by possible measures or combinations of measures such as: (1) diversion limitation for the Aqueduct between April and June, (2) additional modification of the planned Two-Agency Fish and Wildlife Agreement criteria to increase fish populations to adjust for study findings, (3) additional modification of State Water Project storage and export operations to benefit fish, and (4) project funding allocations to enhance fish hatchery activities.

Page 148, Table 6-3

The impact severity rating for the diversion effect on local anadromous fish of Routes 1 and 3 should be changed from low to moderate.

Page 152, paragraph 6.4.6

Change the first sentence to read:

> Although the significance of the aqueduct diversion on the entrainment and/or impingement of anadromous fish using the intake slough is difficult to quantify because of limited data on current fish usage, it would be expected that Lindsey Slough and Cache Slough would be equally sensitive to this effect. This assumption is supported by recently published research done by Ecological Analysts. These findings, published after the Draft ES/EIR was released, show that migrating juvenile striped bass are widespread and not confined to main channels. (See also Section 2, Response 1 to comment letter by National Marine Fisheries Service.)

Page 156, paragraph 6.5.4

Correct the fifth sentence to read:

> Other significant beneficial attributes of a Route 1 alignment would include avoidance of Suisun Marsh, lowest sensitivity with regard to cultural and archaeological resources, use of an established right of way (Sacramento Northern), and a relatively moderate impact on major utilities.

Page 156, paragraph 6.5.8

Reword the first sentence as follows:

> Major disadvantages of Route 4 would be a significantly higher cost for secondary water transport systems to some local contracting agencies, disruption of the urban area through Suisun City including possible relocation requirements for several major utility lines, and displacement of some riparian habitat at the Lindsey Slough intake location.

Page 162, Section 7.0

The impact rating for Impact 13 on Routes 1 and 3 should be changed from "L" to "M".

Page 179, Section 12.0

Under DWR, list the following:

Karl Winkler	Environmental Documentation	4 Years	Project Manager
Wayne MacRostie	Water Resources Engineering	7 Years	Chief Central District
Katy Striemer	Water Resources Legal Section	3 Years	Staff Counsel

Page F-3, Appendix F

The assumption for the North Bay Aqueduct diversion of 110 cfs was used for the hydraulic modeling analysis in the Draft ES/EIR. While the estimated diversion flow was later increased to 115 cfs, the difference would not change any of the conclusions drawn in the draft report.

Correct Assumption 5 to read:

5. The system is operated with the Delta Cross Channel closed. Partly due to the change in this assumption, the preliminary conclusion drawn on page F-12 has been refuted.

Page F-12, Appendix F

Delete the paragraph on this page. This information was presented incorrectly. The information addressed in this paragraph requires explanation of the many parameters that affect the Bay-Delta estuary, such as varying hydrologic conditions and project operations. Response 1 to the comment letter received from the U. S. Environmental Protection Agency (Section 2) provides additional detailed information on modeling studies and shows comprehensive Delta protection.

APPENDIX I
(DRAFT COPY)

A GENERAL DESCRIPTION OF URBAN WATER CONSERVATION MEASURES

Note: Final plans are being evaluated at this time and will be issued at a later date.

Appendix I

A GENERAL DESCRIPTION OF URBAN WATER CONSERVATION MEASURES

I. Education and Public Information

The following water conservation programs and activities are all various methods of educating the consumer on both why and how to conserve water. In addition to promoting the importance of wise water use, the water conservation programs should stress the associated energy savings and financial savings resulting from conserving water. The consumer should be made aware that energy is required to deliver and treat water as well as for heating.

A. Local Water Conservation Advisory Committee

° Local agencies should form an advisory committee consisting of concerned citizens and representatives from the local school district, planning department, industrial and commercial sectors, and community organizations and professional landscape associations.

° The committee will typically be formed at the regional level by the wholesaler.

° The purpose of the committee is to gain input and support for the water conservation program, which should increase the effectiveness and acceptance of the program by the local community.

° The committee should be kept informed of the local water supply and demand situation as well as the local water conservation program.

° The committee should meet a minimum of three times a year.

° The cost of the program will be for staff time to coordinate the committee, organize the meetings, and follow up on recommendations.

B. Conservation Literature

° Literature should be distributed in utility bills (if possible), at public speaking engagements, at locations throughout the community (such as fairs, libraries, environmental organizations' offices, and schools), and at the water agency offices.

° Local water agencies should distribute water conservation literature at least once a year through bill stuffers or a special mailing, in addition to other methods of distribution.

° Water agencies should work with energy utilities and provide them with materials that can be included in their bills.

° Brochures may also be mailed directly to targeted areas, such as new residential areas or business areas.

° Agencies with postcard or computer sealed bills should print a brief water conservation message on the bill two or three times a year.

° The agency can either design and print its own literature or purchase brochures from the Department of Water Resources, American Water Works Association, or other local water agencies. Division of responsibility between the wholesale and retail agencies for this activity will vary between State Water Project contract service areas.

° The primary costs for brochures includes design, printing, and distribution.

° The Department of Water Resources (DWR) and other local agencies can assist in providing ideas for the content (e.g., residential "self help" home audit check lists) and mailing of literature.

1. General Water Conservation Brochure

° Applies to all water users: residential, commercial, public, and industrial.

° Includes water-saving tips on indoor and outdoor water use, potential energy savings, and background information on the need for water conservation from a statewide and local perspective. Also contains sources for additional water conservation information.

2. Landscape Water Conservation Brochure with Plant List

° Includes landscape water conservation tips, a low-water-using plant list appropriate to the area, ideas for designing low-water-using landscapes, and a list of water conservation gardens, arboretums, nurseries, and other examples of water-conserving landscapes. General design ideas for different types of landscapes should be included if appropriate.

° The audience is the homeowner, landscape professionals, nurseries, schools, community organizations, and local government planning, parks, and public works departments.

° Because the landscape brochure and plant list need to be suited to the local climate and environmental conditions, the local agency should either design its own brochure or purchase one from an area of similar climate.

° The Department of Water Resources can serve as a resource center, providing reference material (i.e., low-water-using plant materials, appropriate irrigation systems, concepts of water-conserving landscapes, and a list of growers that can supply low-water-using plant materials).

3. Conservation Literature for Specific Water Users

° Agencies should provide information bulletins on water conservation measures appropriate to specific commercial, public, and industrial water users in their area.

° DWR and other water agencies can be contacted for assistance. LADWP has developed water conservation bulletins for commercial buildings, restaurants, golf courses, health care facilities, laundries and linen suppliers, hotels, schools and colleges, beverage industries, and food processing industries.

C. Previous Year's Use on Water Bills

° Water agencies should provide the previous year's water use information for the same billing period on all water bills. An article or bill-stuffer, explaining how consumers can measure their conservation and providing examples of average monthly water use for different types of users should be submitted to local newspapers or accompany the bill, approximately once a year.

D. Advertising and Promotional Campaigns

1. General Activities

° The local water agencies should promote water conservation through television, radio, and newspaper advertising.

° DWR has television and radio public service announcements, which the local agencies could encourage their local stations to use. Newspaper articles and press releases should accompany water conservation events such as a device distribution program or public speaking presentation. Press releases should be distributed three or four times a year giving information on ways to save water and why. Water agencies should also have updated information on their water supply and use situation to provide to local newspapers, television, and radio stations for use as filler items.

° Water agencies should actively work to promote water conservation through public relations campaigns. Businesses and industries should be asked to post water conservation messages in restrooms, help with demonstration landscapes, and contribute to financing in-school education. Businesses and industries should also be encouraged to let the public know what they are doing to save water in order to demonstrate the level of community involvement.

° The division of responsibility between the wholesale and retail agency will vary between service areas. Because several service areas often receive the same newspapers, television, and radio stations, the advertising program will usually be the responsibility of the wholesaler.

° The staff time and any paid advertising are the primary costs for this program.

2. Public Speaking Presentations

° A public speaking program on various aspects of water conservation should be adopted by the local water agencies.

° Movies and/or slide shows should be designed or acquired to assist the speaker. To save staff time they can also be loaned to other organizations without sending a speaker. A landscape water conservation slide show or movie could be developed or acquired. Department of Water Resources has a slide show and East Bay Municipal Utility District has a movie. Either can be purchased for approximately $40-$50.

° The public speaking program should be publicized to local government agencies, community organizations, professional organizations, businesses, and schools. The local water agency, in cooperation with landscape architects, master gardeners, and nursery people, could sponsor workshops and seminars on low water-using landscapes.

° Water agencies should actively seek speaking engagements on local talk shows or radio programs to present information on the local water situation and conservation programs.

° Staff time and multi-media equipment are the primary costs for this program.

° The division of responsibility between the wholesale and retail agency will vary between service areas.

3. Demonstration Low Water-Using Landscapes

° Local water agencies should locate and promote existing low water-using landscapes within the area. Local agencies could get assistance from local landscape professionals to locate demonstration landscapes.

° The local agencies should choose landscapes that demonstrate a variety of design ideas for different landscape uses and are located in areas of high visibility and use.

° If consent is given by the owner of the property, plant identification signs should be located within the landscape.

° The division of responsibility between the wholesale and retail agency will vary between State Water Project (SWP) contractor service areas. Generally, the SWP contractor will take the lead in locating appropriate sites, with assistance by the retail agencies. Both the SWP contractor and retail agency will usually be responsible for promoting the demonstration landscapes.

° The staff time to organize the program is the primary cost.

° DWR can assist the local agencies in establishing the criteria for the selection of the demonstration landscapes.

4. Promotional Campaign with Nurseries

° Water agencies should work with local plant nurseries to encourage the sale of drought-tolerant plants. Agencies should provide advertisements, literature to be distributed at the nurseries, and plant labels so customers can easily identify drought-tolerant plants.

° Staff time, labels, and advertising are the primary costs for the program.

5. Awards for Conservation Developments

° Local water agencies should sponsor an awards program for conservation developments. Different categories for the awards could include single family homes, multi-family developments, commercial and industrial developments. The local water agency should determine what type of developments in their area should be included in the awards program.

° An awards program for some type of development should be conducted each year. The awards program will typically begin in the second year of the plan.

° Publicity should be extensive to encourage as many contestants as possible to enter the program and to reward the winners. The winning designs or developments could be featured in appropriate professional journals and magazines. Prizes for the winners should be the award and publicity. The water agency will need to conduct a public relations program to obtain support and contributions from the local community.

° The division of responsibility between retail and wholesale agencies will vary between service areas. Generally, the wholesale agency will take the lead because of the regional nature of the program.

° Costs for this program will involve staff time to organize and coordinate the program, advertising costs, and costs to design and print the awards. These costs will vary between SWP contractors.

E. Work with Large Water Users (primarily large industrial users)

° Local water agencies should actively work with the large water users in their area to encourage them to conserve water.

° Agencies should encourage large water users to audit their water use and provide the agency with a breakdown of how much is used in different processes.

° Water agencies should utilize many of the measures mentioned throughout these plans (i.e., brochures, retrofit devices, and community involvement) in their information program for large water users.

° Any water savings made by large users should be given recognition by the agencies and perhaps publicized.

° As customers determine new methods of conservation, the new ideas should be passed along via the water agency to other appropriate customers.

° This program should be coordinated with the equipment loan program (II-D) and the regulations (III-B-1).

F. In-School Education

° All local agencies should adopt an in-school education program within their service area.

° If an elementary school does not exist within their service area, the local agency should work with the appropriate school district and other local water agencies in the area to develop a cooperative program, where costs are shared by several water agencies.

° The agency's work should be adapted to the unique needs of the local school district and carried out by a program coordinator within the school district or county school office.

° The program coordinator within the school district, as well as the individual teachers, should identify the target grades for the program based on materials available through the water agencies and school districts.

° Teacher training workshops are necessary to give teachers an adequate background on local water supply, basics of water consumption, and philosophies of water conservation and to familiarize them with curriculum materials.

° Tours of the water agency facilities should be offered to school children and should be part of a teacher training program.

° The cost for this program is primarily for curriculum materials and teacher training. The curriculum materials should be purchased by local water agencies and made available to the schools. The cost will usually be shared by the retail agencies and the wholesale agencies.

° Currently DWR offers education curriculum materials at a cost of approximately 36 cents per student, along with a teacher training program.

° Schools should be encouraged to retrofit plumbing fixtures and use wise landscape maintenance practices in order to augment in-school education programs and provide a consistent model for children to follow.

G. Information on Federal and State Water Conservation Programs, Laws, and Sanctions

1. Water Conservation Laws

° Local water agencies should work with local governments to assure that the statewide water conservation laws are implemented.

° DWR will act as an information source to local agencies and/or local planning departments to disseminate information on Federal and State policy and statutes such as the low-flush toilet law and the low-flow showerhead, faucet, and hot water insulation regulations.

2. State Tax Credit

° Local water agencies should publicize the existence of the water conservation tax credit to their customers.

II. Water Management Programs

A. Water Loss Reduction Techniques

1. Systemwide Water Audit

° To determine the need for a water audit, all local water agencies, retail and wholesale should provide information to the Department of Water Resources (DWR) on the following topics.

- Underground leaks
- Accuracy range and frequency of testing source of supply meters
- Connection meter maintenance and calibration program
- Illegal connections
- Unmetered connections
- Reservoir overflow
- Record-keeping procedures
- Accounting and billing practices
- Experience and capability of operations personnel

° The purpose of a water audit is to understand where water is going within the water system. Before measures can be taken to reduce the percentage of nonrevenue-producing water (unaccounted for water), an agency must know what portion of its water goes to metered sales, underground leaks, inaccurate meters, and miscellaneous losses.

° DWR should review the information and work with the local agency before a recommendation is made on whether an audit is needed.

2. Leak Detection Program

a. For the agency side of the system:

° All local agencies should have an active leak detection program.

° The responsibility for purchasing the equipment will vary between the service areas. All retail agencies should purchase the equipment unless: (1) a local retail agency is very small and cannot justify purchasing the equipment, (2) neighboring local retail agencies not needing the equipment full time prefer sharing the cost of the equipment, or (3) the local agency prefers hiring a consultant to conduct the leak detection survey.

° Costs for a leak detection program include staff time to conduct the survey and the leak detection equipment. Staff time could range from a part-time employee to as many as eight full-time employees. The equipment costs approximately $1,000-$1,500.

b. For the customer side of the system:

° The local water agency should notify customers if their use has increased or decreased substantially from the previous month or if their water use is significantly higher than similar type customers. The agency should check for meter error and assist customers in checking for leaks when needed.

3. Meter Maintenance and Calibration Program

° All local water agencies, wholesale and retail, should have an active meter maintenance and calibration program for master meters and, if the service area is metered, for customer meters.

° For local agencies that do not have an active and thorough meter maintenance program, the plan will recommend that the local agency either design and implement a meter maintenance program or hire a consultant to design the program and a service company to implement the program.

° Local water agencies regulated by the Public Utilities Commission (PUC) are already required to meet specific PUC requirements on meter maintenance.

° The meter maintenance program should be cost-effective for each water agency. The replacement schedule for meters will depend on the size, type, and age of the meters, water pressure, water quality, geographical location of the service area, and cost of the water. The master meters should be checked for accuracy and replaced more often than customer meters because of the amount of water measured and greater potential for revenue loss due to under-reading.

° As the cost of water increases, the cost effectiveness of meter replacement will tend to increase. To account for the change in cost effectiveness, the design of a meter maintenance program should include different schedules of replacement for the different water prices. This will enable water agencies to change their maintenance program as water prices change without needing to reevaluate the entire program.

° The cost to design a meter maintenance program for a local water agency will vary due to many factors, such as age of the water meters, availability of accurate data on past maintenance, and size of the water system.

4. Corrosion Control Program

° All local water agencies should research the need for a corrosion control program in their service area. If a need exists, the water agency should prepare standards for corrosion control to be implemented within their service area.

° To determine the level of need for a corrosion control program, the following factors should be evaluated by each water agency.

a. Soil Resistivity. This is the one soil characteristic most indicative of corrosivity.

b. Dissimilarities. Dissimilarities between soils or pipe materials will accelerate corrosion.

c. Condition of Existing Pipe.

d. Stray Current. Local sources of stray electrical current can cause corrosion.

e. Exposure. Items not in contact with the soil should be protected with respect to the severity of the environment.

° It is expected that the recommended corrosion control programs will be cost-effective for the local agencies adopting their specific program.

5. Valve Exercising Program

° Agencies should adopt a valve exercising program for their water system. This program will:

- Increase the ability and speed of making repairs.
- Correct valves that have been open and should be closed.
- Make needed pressure adjustments.
- Improve flow efficiency.

° Valves should be exercised an average of once a year or more, if needed.

° The staff time needed for the program can be coordinated with the field work needed for a leak detection program. The staff for exercising valves could share a vehicle with the leak detection staff.

° Water agencies generally already have the necessary equipment to exercise valves. If the service area is large, additional equipment may be needed. The equipment includes a hydraulic valve-turner, which can either be purchased or built by the water utility and can cost as much as $4,000.

6. Accounting for Unmetered Water Use

Local water agencies should:

- Keep records on flushing main lines.
- Meter all hydrant sales.
- Require the fire department to provide information on the amount of water used during training and firefighting.
- Monitor and estimate all other unmetered uses in their service area.

B. Meter Unmetered Uses

° Local agencies should meter all unmetered uses to better account for water use within the service area.

° Metering will be recommended if cost-effective.

C. Device Distribution

° All local agencies should have some type of device distribution program.

° The type of program depends on: (1) whether a device program has been implemented in the service area and the estimated installation and retention rates of that program; (2) the amount of development that existed before the toilet and shower laws; (3) the size and character of the service area; and (4) the ability of the local agency to cover the costs.

° Toilet bags and shower inserts are the recommended devices.

° The minimum program recommendation consists of having devices available free at the water agency office and other central locations, with advertisements several times a year on availability of the devices.

° The maximum program recommendation consists of a large advertising and promotional campaign and devices mass-mailed to all residents. Costs for this program will vary. Estimates range from $0.96 to $1.50 per household. The more households covered, the cheaper the cost per household. The wholesaler should take the lead in administering the program and perhaps coordinate with other wholesalers and utilities to keep the costs low.

° Local energy utilities should be contacted and encouraged to participate in device distribution programs as part of their energy conservation programs.

° A separate method of distribution might be necessary for commercial, public, and industrial customers.

° DWR can assist local agencies in designing an appropriate program for their area, but the water agencies will be responsible for all costs and implementation.

D. Equipment Loan Program for Large Water Users

° Agencies should make water meters and leak detection equipment available to large water users, particularly to industries, to help them determine where water is being used and if there is any waste.

° The wholesale agency will typically be given the responsibility for this program in order to serve the industries and other large water users in a larger service area.

° The cost for the program will include the staff time to organize and promote the program and the cost to purchase the water meters. The number of meters purchased will depend on the amount of industrial water use in the area. About 5-10 meters should be purchased, at a cost of $65-$235 each.

E. Pricing

° A general statement on water rates and a general direction for improvement will be included in all water conservation plans. The following issues and suggestions on water rates will be discussed in the plans.

1. Public utility pricing:

   - How price affects consumption and peak demand.
   - Why prices should reflect the cost of developing new supplies of water and the cost of financing enlargements to the system.

2. Shortcomings of traditional approach to ratemaking:

   - Use of revenue requirements as basis for water rates.
   - Use of year-round rates rather than seasonal rates.
   - A tendency to recover too much revenue from service charges or minimum bills rather than from commodity prices.

3. A general direction for improvement of water rates will include the following suggestions:

   - Base prices on an appreciation of marginal costs.
   - Adopt seasonal rates.
   - Eliminate excess revenues by reducing service charges or using a two-step tariff.

° Specific recommendations on water rates for different water agencies will not be included in the plans.

III. Regulations

DWR can assist local water agencies or planning departments in designing their water conservation regulations.

A. Water Waste Ordinance

° This ordinance should attempt to reduce water waste and excess flow of water onto adjacent property.

° The following uses of water should constitute "waste" as used in this ordinance.

- Landscape runoff.

- Misdirected irrigation water.

- Malfunctioning water equipment.

- Washing down paved surfaces that causes flow onto adjacent property.

Exemptions should include:

- Storm runoff.

- Temporary water system failures.

- Fire hydrant flushing.

- Firefighting and training.

- Water used to abate spills of flammable or hazardous materials.

- Water problems created by wind or vandalism.

- Testing of water supplies.

- Occasional and minimal flow from washing vehicles, boats, streets, sidewalks, or driveways.

- Dust control on construction sites.

The local water agency is responsible for encouraging the adoption of the ordinance by the local city council and/or Board of Supervisors. The responsibility for this program by the wholesaler or retailer will vary between service areas, but will be primarily the responsibility of the wholesaler.

° If, after active encouragement by the local water agency, the legislative body will not approve this measure, it should be promoted by the local water agency as a voluntary measure.

° The retail water agency should implement the ordinance. If the service area is metered, meter readers and other field personnel should police the ordinance. In an unmetered service area, the water agency field personnel, not meter readers, should be responsible for policing the ordinance. If necessary, additional staff should be hired to cover the added workload. If water is being wasted, a warning should be given to the customer. Doorknob hangers are one possible method of warning the customer. Records should be kept of warnings issued and after two warnings the customer should either be fined or, if applicable, a meter installed at the customer's cost. If the waste continues, the customer should be notified that his water will be turned off.

° The policing of the ordinance should focus on large wasters of water or situations of continuous waste of water by certain customers.

° The ordinance and method of policing should be advertised in local newspapers and television as well as through bill stuffers. It is expected that some water waste will stop when the public becomes aware of the ordinance.

° The local agency should assist the large water wasters in reducing the waste by recommending revised irrigation scheduling, new irrigation systems, changing the landscape design, eliminating wasteful practices such as hosing sidewalks, or repairing leaks.

° The major cost of this program is from the staff time for the meter reader or other field personnel, staff time by office personnel to keep records of warnings, and staff time to assist customers in reducing or eliminating the waste.

B. Water Conservation Ordinance/Regulation

1. Requirements for Large Water Users

° New customers applying for water hookups should be required to provide the local agency with projected water use and water conservation measures they plan to use. Agencies should make water conservation recommendations before projects are built.

° Agencies should require large water users to audit their water use and provide agencies with a breakdown of how much water is being used (e.g., sanitation, processing, cooling, etc.). This will make the user aware of where water waste may be occurring as well as where water use could be reduced.

2. Self-Closing Faucets

° This ordinance/regulation should require that all new parks, schools, and other areas of heavy public use install self-closing faucets in public restrooms.

° The ordinance/regulation should either be adopted as a local city ordinance and implemented by the local government or adopted as a condition on new water hookups and implemented by the water agency.

° Due to the higher cost for self-closing faucets, the requirement is only cost-effective in public restrooms where water waste is more common.

3. Low-Water Using Landscapes

° This ordinance/regulation should require that low water-using landscapes be installed in all new public, commercial, industrial, and multi-family home developments. Exemptions include landscapes that will be used for active recreation, such as playing fields.

° The ordinance/regulation should either be implemented by the local planning department in their design review process or by the local water agency by conditioning new water hookups.

° When landscape design is regulated by planning department, the local water agency will be responsible for encouraging the local legislative body to adopt the ordinance and for encouraging the local planning department to implement the ordinance. The major responsibility for this program will typically be given to the wholesale water agency.

° When landscape design is regulated by the water agency, contracts should include the requirements and guidelines to be followed. The landscape regulation will be enforced as a condition on new water hookups.

° A landscape professional should either be added to the planning department or water agency staff or hired as a consultant to provide necessary expertise to evaluate the landscape designs.

° The ordinance/regulation should provide general guidelines for defining low water-using landscapes, but the specific recommendations on type of plants, irrigation, and soil preparation should be the responsibility of the local planning department or water agency staff and decided on a case-by-case basis.

° The low water-using plant list prepared for the landscape brochure can be used as a guide when reviewing designs.

° The following guidelines should be adopted for implementing the ordinance/regulation. In addition to the following guidelines, the local agency implementing the ordinance/regulation should develop requirements and recommendations specific to their area.

a. Low-water using plants should be used when possible.

b. The amount of turf in the landscape should be reduced, depending on how the landscape will be used. Large areas of turf should be allowed only in active-use areas (formal and informal) and in areas of heavy foot traffic. If turf is desired for aesthetic purposes, only small areas should be put in the highly visible locations within a development.

c. Plants should be grouped according to their water, light, soil, and fertilizer requirements to avoid either over-watering or under-watering of plants.

d. Large areas of lawn should be replaced with ground covers, which tend to require less water, fertilizer, and maintenance.

e. Existing trees and shrubs should be preserved and protected wherever possible. Established plants are often adapted to low water conditions.

f. If needed, amendments should be added to the soil before planting, such as fir bark or manure, to increase the soil's water-holding capacity.

g. All landscaped areas, except turf, should be mulched with a 2- to 3-inch layer of woodchips, grass clippings, or dry leaves to reduce evaporation, soil compaction, and weeds.

h. Efficient irrigation systems should be required: drip irrigation systems for trees and shrubs; well-adjusted, low-pressure sprinkler heads for turf and ground covers.

i. Automatic timers with moisture sensor overrides should be required for large landscapes to allow watering during the cool of the day and only when needed.

j. When grading of slopes is needed, the design should minimize runoff.

k. Median islands, landscaping between sidewalks and streets, and berms along streets and sidewalks should not be landscaped with turf and other high-water-using plants because of the need for frequent irrigation, which results in a high level of runoff and water waste.

l. To maximize the use of rainfall, landscape designers should consider storm-retention basins within the landscape. Basins can become a feature of the landscape by being designed as a lake, pond, or creek. The basins can serve as sources of irrigation water and, if needed, recharge basins.

° The primary costs for this program include the staff time of the local water agency and/or planning department to review the landscape designs. The costs will vary between areas.

4. Meters

° This regulation should require that all new developments be metered.

° The cost for this program includes the cost for meters and staff time to install the meters.

C. <u>Reduction in Water System Connection for Conservation Developments (recommended when landscape ordinance isn't recommended)</u>

° Local water agencies should provide an incentive for local developers to conserve water by reducing the connection fee proportionately with the reduction in water demand due to the conservation feature in the development. This would apply to commercial, industrial and multi-family home developments.

° Water agencies regulated by the PUC would not be affected because the PUC doesn't have connection fee charges.

° The water agency should have specific guidelines and requirements to qualify for a fee reduction. For example, as the amount of lawn is reduced, the fee could be reduced.

° The costs for this program will include staff time for designing the guidelines and requirements and for reviewing the landscape designs for compliance.

APPENDIX II
(DRAFT COPY)

SOLANO COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
URBAN WATER CONSERVATION PLAN

Note: Final plans are being evaluated at this time and will be issued at a later date.

Appendix II

SOLANO COUNTY
FLOOD CONTROL AND WATER CONSERVATION DISTRICT
URBAN WATER CONSERVATION PLAN

INTRODUCTION

The recommended urban water conservation plan incorporates measures currently implemented in the service area and adds new measures suited to the character and needs of the service area. The proposed plan will be a cooperative effort between Solano County Flood Control and Water Conservation District (Solano County) and its five retail agencies (the cities of Vallejo, Benicia, Fairfield, Suisun City, and Vacaville), with both the responsibilities and funding shared. It is recommended that Solano County provide a part-time staff person to coordinate and implement the education, public relations, device distribution, and regulatory measures. Each retail agency should provide a part-time staff person to assist Solano County with those measures. In addition, the retail agencies will need additional staff to implement the water management measures. The costs of the water conservation plan should be passed from wholesaler to retailer to customer. Specific recommendations for cost sharing and staff assistance for each agency are described under each conservation measure.

The urban water conservation plan for Solano County focuses on education and public relations measures, water management measures, and regulations for efficient water use in new and existing developments.

The following is an outline of the Solano County water conservation plan that includes the description of agencies' responsibilities, the schedule for implementing each water conservation measure, and an estimate of the cost for each measure. The assumed salaries are $26,000 per year for public information personnel, $32,000 per year for field personnel and $44,000 per year for technical personnel. These salaries include 45 percent overhead for benefits and support staff. For the description of each water conservation measure, refer to the General Description of Urban Water Conservation Measures in Appendix I.

I. EDUCATION AND PUBLIC RELATIONS

A. Local Water Conservation Advisory Committee

Responsibilities

Retail Agencies - Provide suggestions to Solano County on members of the committee, attend all meetings, and assist Solano County in responding to recommendations of the committee.

Solano County - Take lead in organizing the committee, coordinating meetings, and responding to recommendations by the committee.

DWR - Make presentations upon request.

Schedule for Implementation

Form committee within the first three months of the water conservation plan with first meeting within the first six months. Hold committee meetings a minimum of three times a year.

Costs

Retail Agencies - Minimal staff time to assist in forming the committee and to attend meetings.

Solano County - Public information personnel staff time of approximately three weeks the first year and two weeks each following year, at a cost of $1,500 the first year and $1,000 for each year following.

B. Conservation Literature

Responsibilities

Retail Agencies - Purchase and distribute general water conservation literature, a landscape brochure, and brochures for specific water users. Determine and order appropriate brochures for specific water users in service area. Print water conservation message on water bills.

Vacaville - Has drought brochure - needs general brochure. Has plant list but needs updating. Currently prints conservation message on envelope.

Fairfield - Purchase and distribute literature, print message on bills, distribute brochure in bills.

Vallejo - Purchase and distribute literature, print message on bills, distribute literature in special mailing.

Benicia - Purchase and distribute literature, print message on bills, distribute literature in special mailing.

Suisun City - Purchase and distribute literature, print messages on bills, distribute literature in special mailing.

Solano County - Order general water conservation literature and landscape brochures, prepare plant lists (one for Benicia and Vallejo area and one for Fairfield, Suisun City and Vacaville area). Charge retailers for cost of printing or purchasing brochures.

DWR - Provide information on availability of brochures/literature, assist in design and content of brochures.

Schedule of Implementation

Retail Agencies - Purchase and distribute literature every year beginning in first year of the plan. Once a year, literature should be distributed in bills or in a special mailing. Messages on bills should be done two or three times a year.

Solano County - Order literature every year beginning in first year of plan. Design plants lists for landscape brochure in first year of plan.

Costs

Retail Agencies - Costs involve purchasing and distributing literature and staff time of public information personnel to organize the program. Cost estimate to purchase or print brochure is 8¢/brochure; no costs are estimated for the special use brochure. Numbers of brochures purchased of each type should be equal to one-and-one-half times the number of households. Mailing costs estimated for special mailing at 11¢/letter, no cost estimated for distributing brochures in bills. Costs will increase as population increases.

Vacaville -	Two brochures	=		$3,300
	Mailing costs	=	Bill stuffer, no additional cost	
	Staff	=	Two weeks	1,000
	Total	=		$4,300

Fairfield -	Two brochures/year =		$ 3,800
	Mailing =	Bill stuffer, no additional cost	
	Staff =	Two weeks	1,000
	Total =		$ 4,800
Vallejo -	Two brochures/year =		$ 7,500
	Mailing =		3,400
	Staff =	Two weeks	1,000
	Total =		$11,900/ year
Benicia -	Two brochures/year =		$ 1,400
	Mailing =		700
	Staff =	Two weeks	1,000
	Total =		$3,100/ year
Suisun City -	Two brochures/year =		$1,000
	Mailing =		400
	Staff =	Two weeks	1,000
	Total =		$2,400

Solano County - Costs include $3,000 during first year to pay consultant to design two plant lists, $2,000 first year for public information staff to coordinate ordering or printing brochures and hiring a consultant to design plant lists, four weeks staff time. Each following year, $1,000 per year to coordinate ordering brochures, two weeks staff time.

C. Previous Years Use on Water Bills

Responsibilities

Retail Agencies - All agencies need to print previous year's use for same billing period on all water bills.

Solano County - Prepare article on average monthly water use for different types of water uses and distribute to all local newspapers.

Schedule of Implementation

Retail Agencies - Adopt measure within first year of plan, continue each year. Distribute pamphlet yearly.

Solano County - Prepare article within first year of plan, before retail agencies begin printing previous year's water use. Article should be written yearly with revised water use estimates if necessary.

Costs

Retail Agencies - No additional costs estimated.

Solano County - Cost of staff time to prepare article is $1,000 for two weeks in first year and $500 for one week each following year.

D. Advertising and Promotional Campaigns

Responsibilities

Retail Agencies - Encourage local businesses to promote water conservation, speak to local schools and organizations, help locate low water-using landscapes in service areas, help Solano County with awards programs. Vacaville currently has public speaking program.

Solano County - Promote water conservation through television and radio public service announcements, distribute press releases to local newspapers, write articles for local newspapers, work on public relations with large business, speak to local groups, purchase general slide show or movie, develop or purchase landscape slide show, work on landscape professional and retail agencies to identify demonstration landscapes, work with local nurseries to encourage them to promote low water-using plant material, sponsor an awards probram for conservation development.

DWR - Assist in selecting demonstration landscapes and help with promotional ideas. Continue to have slide snow available for purchase (East Bay MUD has a movie available for purchase.)

Schedule of Implementation

Implement all measures except the nursery campaign and awards program within the first year of adopting the plan. Implement awards program and nursery campaign in the second and third years, and continue awards program each year.

Costs

Retail Agencies - One week per year of public information staff time at a cost of $500 each for Benicia and Suisun City. Two weeks of public information staff time each year at a cost of $1,000 for Vacaville, Fairfield and Vallejo.

Solano County - Costs of implementing the plan will be:

For first year:

1. General activities	- 3 weeks	$ 1,500
2. Public speaking presentations	- 4 weeks	2,000
	- develop/purchase slideshow	50
	- landscape slide-show and/or film	50
3. Promoting low water-using landscapes	- 2 weeks	2,000
	- landscape professional	500
	- labels, signs, etc.	500
First year total	- 9 weeks	$ 5,600

For second and third year add:

4. Nursery campaign (one time)	- 3 weeks	$ 1,500
	- advertising	500
5. Awards program	- 4 weeks	2,000
	- advertising	500
	- awards	500
Second and third year totals	- 16 weeks	$10,600
Annual total after third year	- 13 weeks	$ 8,600

E. Work with Large Water Users

Responsibilities

Retail Agencies - Provide Solano County with names and background data on large water users. Also provide current water consumption for large users and periodically provide follow-up consumption data to Solano County.

Solano County - Work with large water users to provide information and any specific brochures and retrofit devices. Work with large users to evaluate the need for water audits and meter loan programs. Also encourage community involvement, e.g., demonstration landscape. Coordinate with the "Equipment Loan Program" and "Requirements for Large Water Users" ordinance described later.

Schedule of Implementation

Retail Agencies - Provide base information to Solano County within first year of plan.

Solano County - Contact all large water users at least once during the first year of the plan's adoption. Make future contacts in conjunction with the other programs mentioned above for large water users.

Costs

Minimal technical staff time for preparation of base data by retail agencies. Two weeks of technical engineer staff time by Solano County estimated at $1,700 for first year. Future costs related to other program for large water users.

F. In-School Education

Responsibilities

Retail Agencies - Provide Solano County a list of all school districts in their service area along with information on any ongoing in-school water conservation programs. Give tours of facilities to teachers and school children.

Solano County - Contact school districts and work with a program coordinator from the school districts. Make arrangements for teacher training program. Hire a consultant for teacher training if necessary. Arrange tours of water agencies and facilities. Provide background information on history of local water conditions and brief overview of State water conditions and facilities. Encourage schools to retrofit plumbing. Provide shower-inserts, if applicable, and toilet devices for tank-type toilets.

DWR - Provide education curriculum materials at cost and provide a teacher training program (contingent on continued funding).

Schedule of Implementation

Implement in-school program within first year of plan adoption, preferably at the beginning of the school year (fall). Continue each year. Bring teachers together for update on current conditions annually thereafter.

Costs

Solano County will incur the following costs for in-school program the first year: public information staff time of four weeks at $2,000; curriculum materials for about two grade levels throughout county or about 6,800 children at 36¢/student is $2,500/year. Costs will increase as enrollment increases; consultant for teacher training (if necessary) at $500. Other costs are minimal.

Future years will not include costs for consultant unless need arises for another teacher training program. All other costs will be about the same.

G. Information on Federal and State Water Conservation Laws, Programs and Sanctions

Responsibilities

Retail Agencies - Publicize existence of water conservation tax credit to customers.

Solano County - Work with local government to assure State water conservation laws are implemented. Publicize tax credit information in public speaking engagements, press releases, etc.

DWR - Provide information on Federal and State policies and regulations.

Schedule of Implementation

This measure should be implemented within the first year of the plan's adoption and continued each year.

Costs

Retail Agencies - Included in other education programs.

Solano County - One week of public information staff time at $500.

II. WATER MANAGEMENT PROGRAMS

A. Techniques for Reducing Water Loss

1. Systemwide Water Audit

<u>Responsibilities</u>

<u>Retail Agencies</u> - Provide information to DWR on how unaccounted for water is calculated, what factors and data are considered in calculations. Conduct audit if recommended by DWR.

<u>DWR</u> - Review local water agency information. Work with the local water agency to determine whether systemwide water audit is needed.

<u>Schedule of Implementation</u>

<u>Retail Agencies</u> - Provide information on unaccounted for water to DWR within first four months of water conservation plan. Conduct audit within first year if recommended.

<u>DWR</u> - Review local water agency information and meet with local agency within one month after receiving information.

<u>Costs</u>

<u>Retail Agency</u> - Technical staff person time to provide the information to DWR of about two weeks at $1,700. Systemwide water audit costs range from $4,000 to $8,000, one-two months staff time for technical staff.

2. Leak Detection Program

a. For the agency side of the system

<u>Responsibilities</u>

<u>Retail Agencies</u> - Implement leak detection program in all retail agencies.

Vacaville - has the equipment but needs to adopt a program.

Fairfield - has the equipment and has program.

Vallejo - has the equipment and just starting a program.

Benicia - plans to purchase equipment and begin training staff within 1981-82 fiscal year.

Suisun City - plans to purchase equipment and begin program in 1982.

DWR - Assist agencies with information on leak detection equipment and how to implement a program.

Schedule of Implementation

Retail Agencies - Initiate program within the second year if not already started; implement on an ongoing basis, not on a spot-check basis.

Costs

One time cost of about $1,500 for equipment. Field staff time at $32,000 per year.

Fairfield - No additional cost, presently implemented.

Benicia - $1,500 for equipment; $64,000 per year for one year, two full-time staff; $8,000 per year, one-fourth time staff.

Suisun City - $1,500 for equipment, $64,000 per year for one year, two full-time staff; $8,000 per year thereafter, one-fourth time staff.

b. For customer side of the system

Responsibilities

Retail Agencies - Notify customers of increased or nontypical water use.

Vacaville - Continue checks for unusual water use and customer leaks. Initiate check for meter error and notify customer of use.

Fairfield - Need to check for unusual water use, notify customer of use, check for meter error or customer leaks as needed.

Vallejo - Continue checks for unusual water use and customer leaks. Initiate check for meter error and notify customer of use.

Benicia - Continue check for unusual use. Initiate checks of customer leaks and meter error and notify customer of use.

Suisun City - Continue check for unusual use. Initiate checks for leaks and meter error and notify customer of use.

Schedule of Implementation

Begin measure within first year of plan and continue each year thereafter.

Costs

Staff time based on a field person salary. Costs for each retail agency are $1,200/year for two weeks staff time. Costs the same for each agency because of compensating differences in size of service area and additional work needed.

3. Meter Maintenance and Calibration Program

Responsibilities

Retail Agencies - Initiate meter maintenance program for master and customer meters.

Vacaville - Design and implement regular schedule of maintenance and replacement for customer and master meters. Design schedule of replacement that corresponds to changing water prices.

Fairfield - Continue 8-year schedule of testing and replacement of customer meters. Design schedule of replacement that corresponds to changing water prices.

Vallejo - Design and implement regular schedule of maintenance and replacement for customer meters. Continue check of master meters twice a year for accuracy. Design schedule of replacement that corresponds to changing water prices.

Benicia - Design and implement regular schedule of maintenance and replacement for customer meters. Continue check of master meters for accuracy about once a year. Design schedule of replacement that corresponds to changing water prices.

Suisun City - Design and implement regular schedule for customer and master meters. Design schedule of replacement that corresponds to changing water prices.

Schedule of Implementation

Design new maintenance programs within the first year and begin implementation the second year.

Costs

Estimated cost to design the maintenance schedule for customer and master meters is about $6,500, which includes one month staff time for field personnel and one month staff time for technical personnel. Costs for each retailer are $6,500 except Fairfield, which has a regular maintenance schedule. Costs have not been estimated for implementing a customer and master meter maintenance program.

4. Corrosion Control Program

Responsibilities

Retail Agencies - Evaluate need for a corrosion control program considering factors listed in the General Description.

Vacaville - Evaluate need for the measure.

Fairfield - Continue current corrosion control program and evaluate need for modifications.

Vallejo - Evaluate need for measure.

Benicia - Evaluate need for measure.

Suisun City - Evaluate need for measure.

Schedule of Implementation

Evaluate need for corrosion control program within first year and begin implementation in second year if needed.

Costs

Technical staff time to evaluate the need for a program estimated at $1,700 for two weeks. Costs not estimated for implementing corrosion control measures because need and extent unknown.

5. Valve Exercising Program

Responsibilities

Retail Agencies - Exercise valves annually.

Vacaville - Continue annual exercise of valves.

Fairfield - Continue annual exercise of valves.

Vallejo - Initiate annual exercise of valves.

Benicia - Initiate annual exercise of valves.

Suisun City - Initiate annual exercise of valves.

Schedule of Implementation

Begin implementation in second year of the plan, if not currently implemented.

Costs

Staff costs for field person based on a $3 per valve to exercise times number of valves in service area. Equipment assumed to already be purchased. Based on current system, costs will increase as system expands.

Vacaville - No additional costs, has program.

Fairfield - No additional costs, has program.

Vallejo - $15,000 per year, 25 weeks per year.

Benicia - $3,000 per year, 5 weeks per year.

Suisun City - $2,700 per year, 5 weeks per year.

6. Accounting for Unmetered Water Use

Responsibilities

Retail Agencies - Improve methods for accounting for unmetered use as needed.

Vacaville - Estimate water use for flushing lines and fire department.

Fairfield - All uses metered and/or estimated.

Vallejo - Estimate water use for flushing lines and fire department.

Benicia - Estimate water use for flushing lines and fire department.

Suisun City - Estimate water use for fire department and flushing lines; hydrant sales should be metered.

<u>Schedule for Implementation</u>

Improve methods for accounting for water use in first year of plan and continue each year thereafter.

<u>Costs</u>

Costs for each retail agency except Fairfield include staff time for a field person of two weeks at $1,200.

B. Meter Unmetered Uses

<u>Responsibilities</u>

<u>Retail Agencies</u> - Meter all parks, schools, playing fields.

Vacaville - 100 percent metered.
Fairfield - 100 percent metered.
Vallejo - Meter parks.
Benicia - 100 percent metered.
Suisun City - Meter parks.

<u>Schedule of Implementation</u>

Install required meters in the first year of the plan.

<u>Costs</u>

Includes purchasing and installing 2-inch meters at about $200 per meter.

Vacaville - No cost.
Fairfield - No cost.
Vallejo - One park - $200.
Benicia - No cost.
Suisun City - Two parks - $400.

C. Device Distribution - Kit Request Program

Responsibilities

Retail Agencies - Help Solano County publicize program. Mail kits by mass mailing technique and keep records of response for evaluation.

Solano County - Take the lead in administering, advertising, and publicizing program.

DWR - Assist in designing program and provide specific information on the kit type of device program.

Schedule of Implementation

Program should be implemented the second year of the plan. Program will take place over a three- to six-month period. Program should be repeated every five years.

Costs

Total program costs per household are estimated to be:

- Kit (60¢ per household x 50% request return rate)..30¢
- Advertising..15¢
- Public Relations (staff time or consultant).........8¢
- Administrative (staff time, overhead, special mailing)..33¢
- Evaluation...5¢

Total...91¢

Total cost for the program is about $65,000: $18,000 for Vallejo, $9,000 for Fairfield, $7,500 for Vacaville, $3,000 for Benicia, $2,500 for Suisun City, and $25,000 for Solano County. Time would be broken down such that Vallejo would spend about 5 weeks, Fairfield and Vacaville 3 weeks, Benicia and Suisun City about 2 weeks, and Solano County would spend 12 weeks of public information staff time. The cost for each 5-year cycle is assumed the same for this estimate.

D. Equipment Loan Program for Large Water Users

Responsibilities

Retail Agencies - Provide information to Solano County on large water users in their service area. Assist Solano County in organizing and promoting program.

Solano County - Take lead in organizing program. Promote program, purchase and loan equipment.

Schedule of Implementation

Program implemented in second year of plan and continued each year.

Costs

Retail Agencies - Minimal staff time, no cost estimated.

Solano County - Includes technical staff time in first year of measure to organize the measure, equal to $2,500, three weeks time. Staff time in following year includes technical person for one week/year at $850 to work with water user, and staff at public information person salary to administer the loan program equals $2,000/year for four weeks. One-time costs for the equipment are estimated as follows:

Meters -	Seven, 1-inch meters at $65	= $ 450
	Three, 1-1/2-inch meters at $165	= $ 500
	TOTAL	$ 950
	Leak detection equipment	= $1,500

E. Pricing

Responsibilities

Retail Agencies - All agencies hire consultant to review rate structures and pricing schedules and to make recommendations to encourage water conservation.

Schedule of Implementation

Hire consultant in first year of the plan. Agencies should begin implementing recommendations as needed in second year of plan.

Costs

Estimated for Vacaville, Fairfield, and Vallejo at $8,000, and for Benicia and Suisun City at $4,000. Costs assume $50 per hour for a consultant. Costs not estimated for implementing recommendations.

III. REGULATIONS

A. Water Waste Ordinance

Responsibilities

Retail Agencies - Assist Solano County in working with its city council to write and adopt ordinance. Implement the ordinance or implement as voluntary measure if not passed as ordinance.

Solano County - Take lead in working with city councils and the County Board of Supervisors to write and adopt the ordinance.

DWR - Provide local agencies with model ordinance or examples of similar ordinances.

Schedule of Implementation

Retail Agencies - Assist Solano County in second year of plan. Implement ordinance once adopted, continue each year.

Solano County - Begin measure in second year, continue working with local legislative bodies as necessary.

Costs

Retail Agencies - For all retail agencies include two weeks in first year of measure for public information staff time to assist Solano County, at $1,000. This cost is in addition to following costs to implement measure, which occur in first year and annually thereafter. Cost to implement measure includes staff time for a field person, which varies between retailers. Material costs to design and print customer warnings includes 10¢ per warning slip times 10 percent of households. Costs will increase with population.

Vacaville -	field staff, two months	$5,000
	materials	100
	Total	$5,100/ year
Fairfield -	field staff, two months	$5,000
	materials	200
	Total	$5,200/ year

Vallejo	- field staff, three months	$7,500
	materials	350
	Total	$7,850/ year
Benicia	- field staff, one month	$2,500
	materials, minimal	--
	Total	$2,500/ year
Suisun City	- field staff, one month	$2,500
	materials, minimal	--
	Total	$2,500/ year

Solano County - Public information staff time equals $2,000 for four weeks.

B. Water Conservation Ordinance/Regulation

Responsibilities

Retail Agencies - Assist Solano County in working with its city council to adopt ordinances. Revise requirements for new water hookups to include conditions on large water users. Define which new users are required to provide information to water agency. Meter ordinance only applies to Suisun City; new parks should be metered.

Solano County - Take lead in working with city councils and Board of Supervisors to adopt the regulations. Work with local planning departments to write ordinance and to prepare guidelines for implementation.

Planning Departments - Review new development plans for compliance with requirements. Recommend changes if needed on landscape plans.

Schedule of Implementation

Adopt and implement ordinances in second year of the plan.

Costs

Retail Agencies - Each agency, $500 in first year of measure for one week public information staff to work with Solano County to adopt ordinances. Technical staff

time to revise regulations for water hookups and make conservation recommendations will vary with each retailer. First year, technical staff time consists of revising regulations and some review of new large water users. Following years staff time primarily for review of new large water users.

Vacaville - $1,600/year, two weeks
Fairfield - $1,600/year, two weeks
Vallejo - $1,600/year, two weeks
Benicia - $800/year, one week
Suisun City - $800/year, one week

Solano County - Public information staff time equals $3,000 for six weeks for the first year.

Local Planning Departments - Each city will require additional staff time to review landscape plans. Salary is estimated at $32,000, which includes 45 percent overhead.

Staff time varies between cities.

Vacaville - $2,500/year, one month
Fairfield - $2,500/year, one month
Vallejo - $2,500/year, one month
Benicia - $1,800/year, three weeks
Suisun City - $1,200/year, two weeks

Summary
Water Agency Suisun City
(1,000 gals/day)

	1990	2000
Laws		
Toilet Law	51.8	80.1
Shower Law	10.7	33.3
Faucet Law	3.3	10.3
Pipe Insulation Law	2.2	8.9
Commercial Toilet Law	4.1	18.6
Subtotal	72.1	151.2
Trends		
Replace Showers	46.2	91.4
Clothewasher Efficiency	2.0	27.8
Dishwasher Efficiency	.6	8.5
Subtotal	48.8	127.7
Conservation Plan		
Retrofit Toilet	10.5	10.4
Retrofit Shower	7.3	1.3
Education, Interior Use	28.1	66.8
Education, Commercial	58.2	103.8
Landscapes, Existing	88.2	174.5
Landscapes, New Multi	2.5	14.3
Landscapes, New Single	8.8	89.5
Industrial Program	--	--
Reduce Water Loss	541.3	1,287.3
Subtotal	744.9	1,747.9
Total	865.8	2,026.8
Population (1,000's)	13.5	16.1
Savings Per Capita (gals/day)	64.1	125.9
Use without Conservation (g/c/d)	540	540
Percent Savings	12	23
Savings in AF/yr	970	2,270

Summary
Water Agency Vallejo
(1,000 gals/day)

Laws	1990	2000
Toilet Law	250.5	397.8
Shower Law	149.1	266.5
Faucet Law	46.1	82.4
Pipe Insulation Law	31.2	66.1
Commercial Toilet Law	8.7	19.9
Subtotal	485.6	832.7
Trends		
Replace Showers	338.5	668.8
Clothewasher Efficiency	30.7	207.9
Dishwasher Efficiency	9.4	63.9
Subtotal	378.6	940.6
Conservation Plan		
Retrofit Toilet	102.6	101.3
Retrofit Shower	53.8	9.7
Education, Interior Use	223.3	500.3
Education, Commercial	43.0	72.3
Landscapes, Existing	159.7	315.7
Landscapes, New Multi	6.2	18.2
Landscapes, New Single	30.6	156.9
Industrial Program	312.1	524.4
Reduce Water Loss	--	--
Subtotal	931.3	1,698.8
Total	1,795.5	3,472.1
Population (1,000's)	107.6	120.5
Savings Per Capita (gals/day)	16.7	28.8
Use without Conservation (g/c/d)	165	165
Percent Savings	10	18
Savings in AF/yr	2,012	3,890

Summary
Water Agency Fairfield
(1,000 gals/day)

Laws	1990	2000
Toilet Law	214.7	318.2
Shower Law	138.1	220.6
Faucet Law	42.7	68.2
Pipe Insulation Law	28.8	53.3
Commercial Toilet Law	18.9	37.6
Subtotal	443.2	697.9
Trends		
Replace Showers	173.2	342.9
Clothewasher Efficiency	28.4	123.9
Dishwasher Efficiency	8.7	38.1
Subtotal	210.3	504.9
Conservation Plan		
Retrofit Toilet	51.4	50.9
Retrofit Shower	27.5	5.0
Education, Interior Use	129.6	298.1
Education, Commercial	146.7	253.2
Landscapes, Existing	167.9	333.0
Landscapes, New Multi	90.5	259.1
Landscapes, New Single	34.1	149.8
Industrial Program	--	--
Reduce Water Loss	--	--
Subtotal	647.7	1,349.1
Total	1,301.2	2,551.9
Population (1,000's)	62.4	71.8
Savings Per Capita (gals/day)	20.9	35.5
Use without Conservation (g/c/d)	240	240
Percent Savings	9	15
Savings in AF/yr	1,457	2,859

Summary
Water Agency Vacaville
(1,000 gals/day)

Laws	1990	2000
Toilet Law	519.1	914.2
Shower Law	365.3	680.5
Faucet Law	113.0	210.4
Pipe Insulation Law	75.7	169.4
Commercial Toilet Law	44.4	108.3
Subtotal	1,117.5	2,082.8
Trends		
Replace Showers	151.7	301.5
Clothewasher Efficiency	75.3	210.4
Dishwasher Efficiency	23.1	64.6
Subtotal	250.1	576.5
Conservation Plan		
Retrofit Toilet	42.2	41.9
Retrofit Shower	24.1	4.4
Education, Interior Use	174.1	503.2
Education, Commercial	104.9	227.3
Landscapes, Existing	164.7	327.9
Landscapes, New Multi	46.4	173.6
Landscapes, New Single	121.9	657.1
Industrial Program	41.9	90.9
Reduce Water Loss	--	--
Subtotal	720.2	2,026.3
Total	2,087.8	4,685.6
Population (1,000's)	83.9	121.2
Savings Per Capita (gals/day)	24.9	38.7
Use without Conservation (g/c/d)	175	175
Percent Savings	14	22
Savings in AF/yr	2,338	5,249

Summary
Water Agency Benicia
(1,000 gals/day)

Laws		
Toilet Law	1990	2000
Shower Law	138.0	178.5
Faucet Law	92.2	124.5
Pipe Insulation Law	28.3	37.7
Commercial Toilet Law	18.9	28.4
Subtotal	7.8	12.4
	285.2	381.5
Trends		
Replace Showers	59.8	117.6
Clothewasher Efficiency	18.8	51.5
Dishwasher Efficiency	5.8	16.1
Subtotal	84.4	186.2
Conservation Plan		
Retrofit Toilet	16.8	16.5
Retrofit Shower	9.5	1.7
Education, Interior Use	55.8	126.4
Education, Commercial	29.6	50.3
Landscapes, Existing	36.7	72.5
Landscapes, New Multi	7.1	17.6
Landscapes, New Single	19.3	67.3
Industrial Program	32.2	54.8
Reduce Water Loss	64.5	146.2
Subtotal	271.5	553.3
Total	641.1	1,121.0
Population (1,000's)	26.9	30.5
Savings Per Capita (gals/day)	23.8	36.8
Use without Conservation	170	170
(g/c/d)	14	22
Percent Savings	718	1,256
Savings in AF/yr		

Summary
Water Agency Remainder of Solano County
(1,000 gals/day)

Laws	1990	2000
Toilet Law	204.5	420.3
Shower Law	163.1	335.3
Faucet Law	50.4	103.7
Pipe Insulation Law	34.0	85.2
Commercial Toilet Law	21.1	58.1
Subtotal	473.1	1,002.6
Trends		
Replace Showers	107.7	214.7
Clothewasher Efficiency	33.6	118.2
Dishwasher Efficiency	10.3	36.3
Subtotal	151.6	369.2
Conservation Plan		
Retrofit Toilet		
Retrofit Shower		
Education, Interior Use		
Education, Commercial		
Landscapes, Existing		
Landscapes, New Multi		
Landscapes, New Single		
Industrial Program		
Reduce Water Loss		
Subtotal	0	0
Total	624.7	1,371.8
Population (1,000's)	48.1	68.5
Savings Per Capita (gals/day)	13.0	20.0
Use without Conservation (g/c/d)	170	170
Percent Savings	8	12
Savings in AF/yr	700	1,537

APPENDIX III
(DRAFT COPY)

NAPA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
URBAN WATER CONSERVATION PLAN

Note: Final plans are being evaluated at this time and will be issued at a later date.

Appendix III

NAPA COUNTY
FLOOD CONTROL AND WATER CONSERVATION DISTRICT
URBAN WATER CONSERVATION PLAN

INTRODUCTION

The recommended urban water conservation plan incorporates measures currently implemented in the service area and adds new measures which are suited to the character and needs of the service area. The proposed plan will be a cooperative effort between Napa County Flood Control and Water Conservation District (Napa County) and its four retail agencies (the cities of Napa, Calistoga, Yountville, and American Canyon Water District), with both the responsibilities and funding shared. It is recommended that Napa County provide a part-time staff person to coordinate and implement the education, public relations, device distribution, and regulatory measures. Each retail agency should provide a part-time staff person to assist Napa County with those measures. In addition, the retail agencies will need additional staff to implement the water management measures. The costs of the water conservation plan should be passed from wholesaler to retailer to customer. Specific recommendations for cost sharing and staff assistance for each agency are described under each conservation measure.

The urban water conservation plan for Napa County focuses on education and public relations measures, water management measures, and regulations for efficient water use in new and existing developments.

The following is an outline of the Napa County water conservation plan that includes the description of agencies' responsibilities, the schedule for implementing each water conservation measure, and an estimate of the cost for each measure. The assumed salaries are $26,000 per year for public information personnel, $32,000 per year for field personnel and $44,000 per year for technical personnel. These salaries include 45 percent overhead for benefits and support staff. For the description of each water conservation measure refer to the General Description of Urban Water Conservation Measures in Appendix I.

I. EDUCATION AND PUBLIC RELATIONS

A. Local Water Conservation Advisory Committee

Responsibilities

Retail Agencies - Provide suggestions to Napa County on members of the committee, attend all meetings, and assist Napa County in responding to recommendations of the committee.

City of Calistoga currently has a Citizens Advisory Committee. A representative from this committee should attend the countywide meetings.

Napa County - Serve as lead in organizing the committee, coordinating meetings and responding to recommendations by the committee.

DWR - Make presentations upon request.

Schedule for Implementation

Form committee within the first 3 months of the water conservation plan with first meeting within the first 6 months. Hold committee meetings a minimum of 3 times a year.

Costs

Retail Agencies - Minimal staff time to assist in forming the committee and to attend meetings.

Napa County - Public information personnel staff time of approximately 3 weeks the first year and two weeks each following year at a cost of $1,500 the first year and $1,000 for each year following.

B. Conservation Literature

Responsibilities

Retail Agencies - Purchase and distribute general water conservation literature, a landscape brochure, and brochures for specific water users. Make at least one distribution by ail. Determine and order appropriate for specific water users in service area. Print water conservation message on water bills.

Calistoga - Has water conservation brochure and distributes every 6 months. Needs landscape brochure. Bills too small to print on.

Yountville - Purchase and distribute literature, print message on bills, distribute brochure in bills.

American Canyon - Purchase and distribute literature, print message on bills, distribute brochure in bills.

Napa - Purchase and distribute literature, print message on bills, distribute literature in special mailing.

Napa County - Order general water conservation literature and landscape brochures, prepare plant list. Charge retailers for cost of printing or purchasing brochures.

DWR - Provide information on availability of brochures/literature. Assist in design and content of brochures.

Schedule of Implementation

Retail Agencies - Purchase and distribute literature every year beginning in first year of the plan. Once a year literature should be distributed in bills or in a special mailing. Messages on bills should be done 2-3 times a year.

Napa County - Order literature every year beginning in first year of plan. Design plants list for landscape brochure in first year of plan.

Costs

Retail Agencies - Costs involve purchasing and distributing literature and staff time of public information personnel to organize the program. Cost estimate to purchase or print brochure is 8¢/brochure, no costs are estimated for the special use brochure. Numbers of brochures purchased of each type should be equal to one-and-one-half times the number of households. Mailing costs estimated for special mailing at 11¢/letter, no cost estimated for distributing brochures in bills. Costs will increase as population increases.

Yountville - Two brochures	=		$ 200
Mailing costs	=	bill stuffer, no additional cost	
Staff	=	Two weeks	1,000
Total	=		$ 1,200
American Canyon - Two brochures/year	=		$ 500
Mailing	=	bill stuffer, no additional cost	
Staff	=	Two weeks	1,000
Total	=		$ 1,500
Napa - Two brochures/year	=		$ 4,700
Mailing	=		2,100
Staff	=	Two weeks	1,000
Total	=		$ 7,800/year
Calistoga - One landscape brochure/year	=		$ 200
Staff	=	One week	500
Total	=		$ 700/year

Napa County - Costs include $2,000 during first year to pay consultant to design a plant list, $1,500 first year for 3 weeks public information staff to coordinate ordering or printing brochures and hire consultant to design plant lists. One thousand dollars per year each following year to coordinate ordering brochures; two weeks staff time.

C. Previous Years Use on Water Bills

Responsibilities

Retail Agencies - All agencies need to print previous years use for same billing period on all water bills.

Napa County - Prepare article on average monthly water use for different types of water uses and distribute to all local newspapers.

Schedule of Implementation

Retail Agencies - Adopt measure within first year of plan, continue each year.

Napa County - Prepare article within first year of plan, before retail agencies begin printing previous years water use. Article should be written yearly with revised water use estimates if necessary.

Costs

Retail Agencies - No additional costs estimated.

Napa County - Cost of staff time to prepare article is $1,000 for two weeks in first year and $500 for one week each following year.

D. Advertising and Promotional Campaigns

Responsibilities

Retail Agencies - Encourage local businesses to promote water conservation, speak to local schools and organizations, help locate low water-using landscapes in service areas, help Napa County with awards programs. Calistoga currently speaks to schools and community groups.

Napa County - Promote water conservation through TV and radio public service announcements, distribute press releases to local newspapers, write articles for local newspapers, work on public relations with large businesses, speak to local groups, purchase general slide show or movie, develop/purchase landscape slide show, work with landscape professional and retail agencies to identify demonstration landscapes, work with local nurseries to encourage them to promote low water-using plant material, sponsor an awards program for conservation developments.

DWR - Assist in selecting demonstration landscapes and help with promotional ideas. Continue to have slide show available for purchase (East Bay MUD has a movie available for purchase).

Schedule of Implementation

Implement all measures except the nursery campaign and awards program within the first year of adopting the plan. Implement awards program and nursery campaign in the second and third year, and continue awards program each year.

Costs

Retail Agencies - One week per year of public information staff time at a cost of $500 each for Yountville, Calistoga and American Canyon. Two weeks of public information staff time each year at a cost of $1,000 for Napa.

Napa County - Costs of implementing the plan will be:

For first year:

1.	General activities	- 2 weeks	$ 1,000
2.	Public speaking presentations	- 4 weeks	2,000
		- develop/purchase slide show	50
		- landscape slide show and/or film	50
3.	Low water-using landscapes promotion	- 2 weeks	1,000
		- landscape professional	500
		- labels, signs, etc.	500
	First year total	- 8 weeks	$ 5,100

For second and third year add:

4.	Nursery campaign (one time)	- 3 weeks	$ 1,500
		- advertising	500
5.	Awards program	- 4 weeks	2,000
		- advertising	500
		- awards	500
	Second and third year totals	- 15 weeks	$10,100
	Annual total after third year	- 12 weeks	$ 8,100

E. Work with Large Water Users

Responsibilities

Retail Agencies - Provide Napa County with names and background data on large water users. Also provide current water consumption for large users and periodically provide followup consumption data to Napa County.

Napa County - Work with large water users to provide landscape information and any specific brochures and retrofit devices. Work with large users to evaluate the need for water audits and meter loan programs. Also encourage community involvement, e.g., demonstration landscape. Coordinate with the "Equipment Loan Program" and "Requirements for Large Water Users" ordinance described later.

Schedule of Implementation:

Retail Agencies - Provide base information to Napa County within first year of plan.

Napa County - Contact all large water users at least once during the first year of the plan's adoption. Make future contacts in conjunction with the other programs mentioned above for large water users.

Costs:

Minimal technical staff time for preparation of base data by retail agencies. Two weeks of technical engineer staff time by Napa County estimated at $1,700 for first year. Future costs related to other program for large water users.

F. In-School Education

Responsibilities:

Retail Agencies - Provide Napa County a list of all school districts in its service area along with information on any ongoing in-school water conservation programs. Give tours of its facilities to teachers and school children. City of Calistoga is currently funding an in-school program for K-8, purchasing materials from DWR.

Napa County - Contact school districts and work with a program coordinator from the school districts. Make arrangements for teacher training program. Hire a consultant for teacher training if necessary. Arrange tours of water agencies and facilities. Provide background information on history of local water conditions and brief overview of State water conditions and facilities. Encourage schools to retrofit plumbing. Provide shower-inserts, if applicable, and toilet devices for tank-type toilets.

DWR - Provide education curriculum materials at cost and provide a teacher training program (contingent on continued funding).

Schedule of Implementation

Implement in-school program within first year of plan adoption, preferably at the beginning of the school year (fall). Continue each year. Bring teachers together for update on current conditions annually thereafter.

Costs:

Napa County will incur the following costs for an in-school program the first year: public information staff time of 3 weeks at $1,500; curriculum materials for about two grade levels throughout county or about 2,100 children at 36¢/student is $800 (costs will increase as enrollment increases), consultant for teacher training (if necessary at $500). Other costs are minimal.

Future years will not include costs for consultant unless need arises for another teacher training program. All other costs will be about the same.

G. Information on Federal and State Water Conservation Laws, Programs and Sanctions

Responsibilities

Retail Agencies - Publicize existence of water conservation tax credit to customers.

Napa County - Work with local government to assure State water conservation laws are implemented. Publicize tax credit information in public speaking engagements, press releases, etc.

DWR - Provide information on Federal and State policies and regulations.

Schedule of Implementation

This measure should be implemented within the first year of the plan's adoption and continued each year.

Costs

Retail Agencies - Included in other education programs.

Napa County - One week of public infor ation staff time at $500.

II. WATER MANAGEMENT PROGRAMS

A. Techniques for Reducing Water Loss

1. Systemwide Water Audit

Responsibilities

Retail Agencies - Provide information to DWR on how unaccounted for water is calculated, what factors and data are considered in calculations. Conduct audit if recommended by DWR.

DWR - Review water agency information. Work with the water agency to determine if systemwide water audit is needed.

Schedule of Implementation

Retail Agencies - Provide information on unaccounted for water to DWR within first 4 months of water conservation plan. Conduct audit within first year if recommended.

DWR - Review water agency information and meet with agency within one month after receiving information.

Costs

Retail Agencies - Technical staff person time to provide the information to DWR of about two weeks at $1,700 each. Systemwide water audit costs range from $4,000 to $8,000, one-two months staff time for technical staff.

2. Leak Detection Program

a. For the agency side of the system

Responsibilities

Retail Agencies - Implement leak detection program in all retail agencies.

Calistoga - Has the equipment but needs to adopt an ongoing program.

Napa - Needs to purchase equipment and adopt ongoing program.

Yountville - Needs to contract with firm or agency for program.

American Canyon - Needs to contract with firm or agency for program.

DWR - Assist agencies with information on leak detection equipment and how to implement a program.

Schedule of Implementation

Retail Agencies - Initiate program within the second year; implement on an ongoing basis, not on a spot check basis.

Costs

One time cost of approximately $1,500 for equipment. Field staff time at $32,000 per year. Contracted work is assumed to cost $250 per mile of water line.

Napa - $1,500 for equipment; $64,000 per year for 3 years, two full-time staff; $16,000 per year thereafter, one-half-time staff.

Yountville - Contracted at $1,500 for one year and $700 per year thereafter.

Calistoga - Contracted at $5,000 for one year and use own equipment at $1,000 per year thereafter.

b. For customer side of the system

Responsibilities

Retail Agencies - Notify customers of increased or nontypical water use.

Napa - Continue present check for unusual water use and customer notification. Initiate check of meter error and customer leaks.

American Canyon - Continue present check for unusual water use and meter error. Increase frequency of checks and add check for leaks and customer notification.

Calistoga - Continue check for unusual water use and customer notification. Initiate check for meter error and customer leaks.

Yountville - Continue and increase frequency of present checks for unusual use and meter error. Initiate checks of customer leaks and notify customer of use.

Schedule of Implementation

Begin measure within first year of plan and continue each year thereafter.

Costs

Staff time based on a field person salary. Additional costs for Napa are $1,200/year for two weeks staff time. Additional costs for all other retail agencies are $600 per year for one week staff time.

3. Meter Maintenance and Calibration Program

Responsibilities

Retail Agencies - Initiate meter maintenance program for master and customer meters.

Napa - Design and implement regular schedule of maintenance and replacement for customer and master meters. Design schedule of replacement that corresponds to changing water prices.

Calistoga - Continue regular schedule of testing and repair of customer meters. Design schedule of replacement that corresponds to changing water prices.

American Canyon - Regular schedule of maintenance and replacement needs to be designed and implemented for customer meters. Continue present check of master meters twice a year for accuracy. Design schedule of replacement that corresponds to changing water prices.

Yountville - Continue annual calibration of meters. Design and implement regular schedule of maintenance and replacement for customer meters. Design schedule of replacement that corresponds to changing water prices.

Schedule of Implementation

Design new maintenance programs within the first year and begin implementation the second year.

Costs

Estimated cos: to design the maintenance schedule for customer and master meters for Napa is approximately $6,500 -- includes one month staff time for field personnel and one month staff time for technical personnel. Costs for the other retail agencies are $3,300 (two weeks for field personnel and two weeks for technical personnel). No cost for Calistoga which has a regular maintenance schedule. Costs have not been esti ated for implementing a customer meter maintenance program.

4. Corrosion Control Program

Responsibilities

Retail Agencies - Evaluate need for a corrosion control program considering factors listed in the General Description.

Schedule of Implementation

Evaluate need for corrosion control program within first year and begin implementation in second year if needed.

Costs

Technical staff time t- evaluate the need for a program estimated at $1,700 for two weeks. Costs not estimated for implementing corrosion control measures because need and extent unknown.

5. Valve Exercising Program

Responsibilities

Retail Agencies - Exercise valves annually.

Yountville - Con' ..e present exercise of valves twice annually.

American Canyon - Initiate anual exercise of valves.

Napa - Initiate annual exercise of valves.

Calistoga - Initiate annual exercise of valves.

Schedule of Implementation

Begin implementation in second year of the plan, if not currently implemented.

Costs

Staff costs based on a $3 per valve to exercise, times number of valves estimated in service area. Equipment assumed to already be purchased. Costs will increase as system expands.

Yountville - No additional costs, has current program.

American Canyon - $900 per year for 1.5 weeks field staff time.

Calistoga - $900 per year for 1.5 weeks field staff time.

Napa - $9,900 per year for 3 months field staff time.

6. Accounting for Unmetered Water Use

Responsibilities

Retail Agencies - Improve methods for accounting for unmetered use as needed.

Napa - Estimate water use for flushing lines and fire department.

Calistoga - Meter hydrant sales.

American Canyon - Estimate water use for flushing lines and fire department.

Yountville - Estimate water use for flushing lines and fire department.

Schedule for Implementation

Improve methods for accounting for water use in first year of plan, and continue each year thereafter.

Costs

Costs for Napa include staff time for a field person of two weeks at $1,200; for 15¢/year and one week at $600 each year following. Rest require one week staff time at $600 for the first year of plan and $300 each year following.

B. Meter Unmetered Uses

Responsibilities

Retail Agencies - Meter parks, schools, playing fields. All uses currently metered in all agencies.

Schedule of Implementation

Not required.

Costs

None.

C. Device Distribution - Kit Request Program

Responsibilities:

Retail Agencies - Help Napa County publicize program. Mail kits by mass mailing technique and keep records of response for evaluation.

Napa County - Take the lead in administering, advertising and publicizing program and ordering kits.

DWR - Assist in designing program and provide specific information on the kit type of device program.

Schedule of Implementation:

Program should be implemented the second year of the plan. Program will take place over a three- to six-month period. Program should be repeated every 5 years.

Costs:

Total program costs per household are estimated to be:

- Kit (60¢ per household x 50% request return rate)..30c
- Advertising..15¢
- Public Relations (staff time or consultant).........8¢
- Administrative (staff time, overhead, special mailing..33¢
- Evaluation...5¢

Total 91¢

Total cost for the program is about $25,000: $12,000 for Napa, $1,500 each for Calistoga and American Canyon, $1,000 for Yountville, and $9,000 for Napa County. Time could be broken down such that Calistoga, American Canyon and Yountville would each spend approximately one week public information staff time, Napa 5 weeks public information staff time and Napa County would spend 6 weeks public information staff time. The cost for each 5-year cycle is assumed the same for this estimate.

D. Equipment Loan Program for Large Water Users

Responsibilities

Retail Agencies - Provide information to Napa County on large water users in its service area. Assist Napa County in organizing and promoting program.

Napa County - Serve as lead in organizing program. Promote program, purchase and loan equipment.

Schedule of Implementation

Program implemented in second year of plan, and continued each year.

Costs

Retail Agencies - Minimal staff time, no cost estimated.

Napa County - Includes technical staff time in first year of measure to organize the measure equal to $2,500, 3 weeks time. Staff time in following year includes technical person for one week/year at $850 to work with water user, and staff at public information person salary to administer the loan program equals $2,000/year for one month. One time costs for the equipment are estimated as follows:

Meters -	5 one-inch meters at $65/each	= $330
	two 1-1/2-inch meters at $165/each	= $330
	TOTAL	$660

Leak detection equipment at $1,500

E. Pricing

Responsibilities

Retail Agencies - All agencies hire consultant to review current rate structures and pricing schedules and to make recommendations as needed which encourage water conservation.

Schedule of Implementation

Hire consultant in first year of the plan. As needed agencies should begin implementing recommendations in second year of plan.

Costs

Estimated for Napa at $8,000 and for Calistoga, American Canyon, and Yountville at $4,000. Costs assume $50 per hour for a consultant. Costs not estimated for implementing recommendations.

III. REGULATIONS

A. Water Waste Ordinance

Responsibilities

Retail Agencies - Assist Napa County in working with its city council to write and adopt ordinance. Implement the ordinance or implement as voluntary mesure if not passed as ordinance. The City of Calistoga has a water conservation measure ordinance which prohibits nonessential uses of water to a greater degree than recommended under normal circumstances. It should be modified as new water supplies become available.

Napa County - Serve as lead in working with city councils and the County Board of Supervisors to write and adopt the ordinance.

Schedule of Implementation

Retail Agencies - Assist Napa in second year of plan. Implement ordinance once adopted, continue each year.

Napa County - Begin measure in second year, continue working with local legislative bodies as necessary.

Costs

Retail Agencies - For American Canyon and Yountville include one week each, in first year of measure, for public information person to assist Napa County at a cost of $500 each. Include two weeks time for City of Napa for same purpose at a cost of $1,000. This one time cost is in addition to the following yearly costs to implement the measure. Material costs to design and print customer warnings includes 10¢ per warning slip, times 10 percent of households. Costs will increase as population increases.

Yountville -	field staff, 2 weeks materials minimal cost	$ 1,300
American Canyon -	field staff, 3 weeks materials minimal cost	$ 1,900
Napa -	field staff, two months	$ 5,000
	materials	200
	Total	$ 5,200

Napa County - Public information staff time equals $1,500 for 3 weeks for first year only.

B. Water Conservation Ordinance/Regulation

Responsibilities

Retail Agencies - Assist Napa County in working with its city councils or County Board of Supervisors to adopt ordinances. Revise their requirements for new water hookups to include conditions on large water users. Define which new users are required to provide information to water agency. Calistoga should review the need to revise its current ordinance to include requirements for large water users and requirements for self-closing faucets.

Napa County - Serve as lead in working with city councils and Board of Supervisors to adopt the regulations. Work with local planning departments to write ordinance and to prepare guidelines for implementation.

Planning Departments - Review new development plans for compliance with requirements. Recommend changes if needed on landscape plans.

Schedule of Implementation

Adopt and implement ordinances in second year of the plan.

Costs

Retail Agencies - In first year of measure American Canyon, Calistoga and Yountville, $250 each for one-half week public information staff and City of Napa $500 for one week, to work with Napa County to adopt ordinances. Technical staff time to revise regulations for water hookups and make conservation recommendations, will vary with each retailer. First year, technical staff time consists of revising regulations and some review of new large water users. Following years staff time primarily review of new large water users.

Calistoga	- $400/year, one-half week
Yountville	- $400/year, one-half week
City of Napa	- $1,200/year, one-and-one-half weeks
American Canyon	- $800/year, one week

Napa County - Public information staff time equals $2,000 for 4 weeks for the first year.

Planning Departments - Each department will require additional staff time to review landscape plans. Calistoga's planning department is currently reviewing landscapes. Salary is estimated at $32,000 which includes 45 percent overhead. Staff time varies between departments.

Yountville	- $ 600/year,	one week
American Canyon	- $ 900/year,	one-and-one-half weeks
City of Napa	- $2,500/year,	4 weeks

Summary
Water Agency Napa
(1,000 gals/day)

Laws	1990	2000
Toilet Law	23.9	73.5
Shower Law	9.2	48.8
Faucet Law	2.9	15.1
Pipe Insulation Law	2.1	25.9
Commercial Toilet Law	0.3	2.0
Subtotal	39.4	165.3
Trends		
Replace Showers	188.6	379.7
Clothewasher Efficiency	1.9	92.1
Dishwasher Efficiency	0.6	28.3
Subtotal	191.1	500.1
Conservation Plan		
Retrofit Toilet	59.9	59.4
Retrofit Shower	30.0	5.5
Education, Interior Use	101.7	221.7
Education, Commercial	103.0	168.3
Landscapes, Existing	154.4	306.7
Landscapes, New Multi	5.6	42.8
Landscapes, New Single	3.0	53.3
Industrial Program	29.4	48.1
Reduce Water Loss	49.0	106.8
Subtotal	536.0	1,012.6
Total	766.5	1,678.0
Population (1,000's)	49.0	53.4
Savings Per Capita (gals/day)	15.6	31.4
Use without Conservation (g/c/d)	200	200
Percent Savings	8	16
Savings in AF/yr	858	1,879

Summary
Water Agency Calistoga
(1,000 gals/day)

	1990	2000
Laws		
Toilet Law	35.8	48.2
Shower Law	26.6	36.5
Faucet Law	8.2	11.3
Pipe Insulation Law	5.5	8.5
Commercial Toilet Law	5.2	8.3
Subtotal	81.4	112.8
Trends		
Replace Showers	14.5	28.7
Clothewasher Efficiency	5.5	14.1
Dishwasher Efficiency	1.7	4.3
Subtotal	21.7	47.1
Conservation Plan		
Retrofit Toilet	4.4	4.4
Retrofit Shower	2.3	.4
Education, Interior Use	14.6	33.9
Education, Commercial	10.8	18.7
Landscapes, Existing	5.9	11.7
Landscapes, New Multi	9.7	22.3
Landscapes, New Single	1.5	5.3
Industrial Program	--	--
Reduce Water Loss	47.8	111.1
Subtotal	97.0	207.8
Total	200.1	367.7
Population (1,000's)	7.0	8.2
Savings Per Capita (gals/day)	28.6	44.8
Use without Conservation (g/c/d)	182	182
Percent Savings	16	25
Savings in AF/yr	224	412

Summary
Water Agency American Canyon
(1,000 gals/day)

	1990	2000
Laws		
Toilet Law	37.3	39.6
Shower Law	29.7	31.6
Faucet Law	9.2	9.8
Pipe Insulation Law	6.2	6.8
Commercial Toilet Law	5.6	6.1
Subtotal	88.0	93.9
Trends		
Replace Showers	21.9	42.9
Clothewasher Efficiency	6.1	16.3
Dishwasher Efficiency	1.9	5.0
Subtotal	29.9	64.2
Conservation Plan		
Retrofit Toilet	7.1	7.0
Retrofit Shower	3.5	.6
Education, Interior Use	19.4	39.3
Education, Commercial	12.2	18.4
Landscapes, Existing	13.3	26.2
Landscapes, New Multi	21.3	33.5
Landscapes, New Single	7.2	17.6
Industrial Program	2.7	4.1
Reduce Water Loss	--	--
Subtotal	86.7	146.7
Total	204.6	304.8
Population (1,000's)	9.4	9.5
Savings Per Capita (gals/day)	21.8	32.1
Use without Conservation (g/c/d)	143	143
Percent Savings	15	22
Savings in AF/yr	229	341

Summary
Water Agency Yountville
(1,000 gals/day)

Laws	1990	2000
Toilet Law	.9	3.1
Shower Law	.2	1.9
Faucet Law	--	.6
Pipe Insulation Law	--	.6
Commercial Toilet Law	.1	1.1
Subtotal	1.2	7.3
Trends		
Replace Showers	5.7	1.1
Clothewasher Efficiency	--	2.9
Dishwasher Efficiency	--	.9
Subtotal	5.7	4.9
Conservation Plan		
Retrofit Toilet	1.8	1.8
Retrofit Shower	1.7	.9
Education, Interior Use	3.1	7.0
Education, Commercial	1.9	3.2
Landscapes, Existing	3.6	7.2
Landscapes, New Multi	.3	5.1
Landscapes, New Single	--	.2
Industrial Program	--	--
Reduce Water Loss	7.0	15.9
Subtotal	19.4	41.3
Total	26.3	53.5
Population (1,000's)	1.5	1.7
Savings Per Capita (gals/day)	17.5	31.5
Use without Conservation (g/c/d)	200	200
Percent Savings	9	16
Savings in AF/yr	29	60

Summary
Water Agency Remainder of Napa County
(1,000 gals/day)

Laws	1990	2000
Toilet Law	20.3	23.9
Shower Law	16.2	19.0
Faucet Law	5.0	5.9
Pipe Insulation Law	3.5	6.3
Commercial Toilet Law	2.4	4.7
Subtotal	47.4	59.8
Trends		
Replace Showers	135.2	267.7
Clothewasher Efficiency	3.3	67.0
Dishwasher Efficiency	1.0	20.6
Subtotal	139.5	355.3
Conservation Plan		
Retrofit Toilet		
Retrofit Shower		
Education, Interior Use		
Education, Commercial		
Landscapes, Existing		
Landscapes, New Multi		
Landscapes, New Single		
Industrial Program		
Reduce Water Loss		
Subtotal	0	0
Total	186.9	415.1
Population (1,000's)	37.9	38.8
Savings Per Capita (gals/day)	4.9	10.7
Use without Conservation (g/c/d)	200	200
Percent Savings	2	5
Savings in AF/yr	209	465

APPENDIX IV

SUBSURFACE ARCHAEOLOGICAL INVESTIGATIONS AT CA-SOL-268: NORTH BAY AQUEDUCT PROJECT, SOLANO COUNTY, CALIFORNIA

Prepared for:

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December 1981

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State of California The Resources Agency of California

Memorandum

Date :

To : Wayne McRostie, Chief
Central District
Department of Water Resources
3251 S Street
Sacramento, CA 95814

From : Department of Parks and Recreation

Subject: NORTH BAY AQUEDUCT - ARCHEOLOGICAL ASSESSMENT

Thank you for the opportunity to review the archaeological report prepared by David Chavez for the project cited above.

During telephone discussions between Mr. Chavez and Nicholas Del Cioppo of my staff it was ascertained the archaeological site in question, Sol-268, has been destroyed since it was noted in 1977. Thus, the reason for our concurrence with Mr. Chavez's determination that your project will not damage a significant cultural resource.

If you have any questions, please direct them to Nicholas Del Cioppo, State Archaeologist II, by calling (916) 322-8703.

Knox Mellon

Dr. Knox Mellon
State Historic Preservation Officer
Office of Historic Preservation

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CONTENTS

INTRODUCTION

In August 1980, a Cultural Resources Evaluation was accomplished for the North Bay Aqueduct Alignment Alternatives in Solano County, California. That study consisted of both archival review and field survey efforts for the three alternative aqueduct routes. That Cultural Resources Investigation (Chavez, 1980) resulted in the conclusion that one previously recorded prehistoric archaeological site (CA-Sol-268) was located within a portion of the alignment corridor which included all three alternative routes (see Map I).

The site was originally recorded in 1977 by archaeologist Eric McGuire and described at that time as a partially destroyed shallow midden deposit, with obsidian flakes and shell fragments present. The site dimensions were estimated to be 10 meters x 20 meters. Inspection of the site location in 1980 resulted in the observation that some obsidian flakes and shell fragments were present; however, the site appeared to be badly damaged. Further, it was not possible to define the horizontal and vertical boundaries of the site from surface observations. It was therefore concluded that despite the fact that portions of the site had been destroyed, no assumptions should be made concerning the potential for subsurface, intact archaeological deposits which could be disturbed as a result of project related construction activities at that location.

Avoidance of the resource was recommended; it however presently appears that such measures are unlikely. Consequently, in December 1981, Madrone Associates requested that the site CA-Sol-268 be subjected to a subsurface archaeological testing program. The objectives of the investigation were defined as follows:

1. Determine if subsurface archaeological deposits are present at the site location.

2. Determine the horizontal and vertical extent of the site.

3. Based on National Register of Historic Places Criteria, establish the significance of the site.

4. Present appropriately detailed impact and mitigation discussions, in regard to the proposed North Bay Aqueduct Project.

FIELD INVESTIGATIONS

The subsurface archaeological investigations were accomplished on December 8, 9 and 10, 1981. The field procedures were accomplished by the consultant David Chavez and professional archaeologists Lowell Damon and James P. Quinn Suskol Indian Council consultant Lois Whipple was present during the testing procedures.

Methodology

The field investigations were initiated by conducting a thorough surface inspection of the site location; the purpose of the inspection was to estimate where the greater concentration of surface deposits were located. Surface survey conditions were excellent and a complete inspection of the site area was accomplished. Less surface evidence of archaeological deposits was encountered than was reported in 1977 and observed during the aqueduct survey (Chavez, 1980:24). No shell or midden deposits were detected, nor was it possible to tentatively identify any area of concentrated prehistoric remains. Present evidence of the site CA-Sol-268 was limited to a few obsidian flakes randomly located throughout the subject location. It was observed that the site was less definable and in a state of greater destruction than noted in 1980.

The augering program of the site location was initiated by establishing a baseline at the foot of the naturally occurring hill. Wooden stakes were then placed along the baseline at approximately ten-meter intervals (see Map II, Units 1 through 11). A roughly ten-meter-square grid pattern was then established up-slope from that baseline, and the staked locations were systematically numbered (Units 1 through 41). The stake locations were then systematically augered row-by-row from the baseline up the slope. The rational for this testing approached was based on two preliminary observations:

1. No focal point of archaeologically related deposits could be established anywhere in the general site locale.

2. The only archaeological remains (obsidian flakes) encountered during the current surface inspection were observed up-slope from the established baseline.

It is noted that some auger unit locations vary from the 10 meter square grid pattern (Units 22, 23 and 24); some obsidian flakes were encountered at that location, which is directly in line with Department of Water Resources' flaggings, and the placement of more units at that specific locale was believed to be an appropriate measure.

The subsurface exploration of the site locale was accomplished by hand augering small diameter (2") borings at each of the initial 41 staked test unit locations. Augerings were initiated on the baseline and units were tested essentially by following the order in which they were numbered. Additional test units were eventually established (Units 42 through 52) in the pasture area southeast of the baseline, despite the fact that no surface evidence of archaeological deposits was encountered in that area. It was believed, however, that test units in that locale would more thoroughly relate the testing findings to the overall aqueduct corridor alignment.

During the course of the entire testing program, detailed records were kept concerning the changes in subsurface soil profiles and the presence (and/or absence) of soil constituents (natural and cultural). Sample screening of soil at various depths from auger borings located throughout the testing area was accomplished with a 1/8" mesh shaker screen.

Findings

A review and comparison of the auger boring records from the various portions of the testing area resulted in the realization that the stratigraphic profile of different sections of the locale were relatively uniform in soil deposits and levels at which they were encountered. The general subsurface conditions of the site location are depicted in profile in Figure 1. Those conditions can be summarized by test area segments which are generally defined by the relationship of the location to the top (or bottom) of the hillside; the auger boring results are therefore presented as follows:

- The higher elevation segment of the testing area (Units 29 through 35, 38, 39 and 40), was characterized by a relatively shallow soil overburden (medium-brown clayey loan), which extended to a relatively uniform depth of approximately 18 centimeters; at which point bedrock was uniformly encountered. No evidence of prehistoric cultural deposits was observed in any of the test units in this segment of the area.

- The medium elevation segment of the testing area (Units 10 through 17, 26 through 28, 36, 37 and 41) was characterized by a medium-brown clayey loan soil to a relatively uniform depth of approximately 35 centimeters; at which point bedrock was uniformly encountered. No evidence of prehistoric cultural deposits was observed in any of the test units in this segment of the area.

- The lower elevation segment of the testing area (Units 1 through 9, 18 through 25, 42 through 52) was charac-

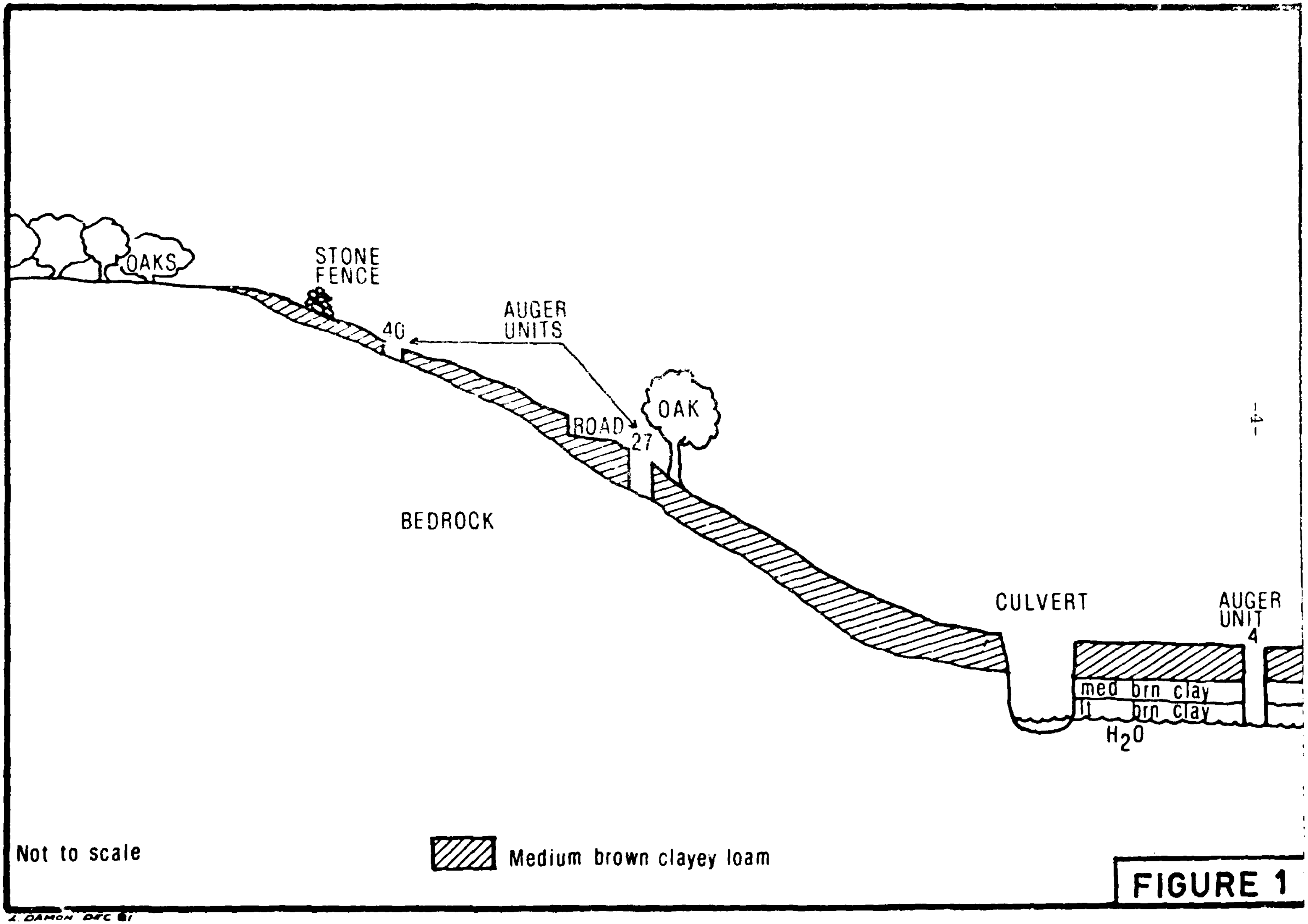

OAKS
STONE FENCE
AUGER UNITS
40
ROAD
27
OAK
BEDROCK
CULVERT
AUGER UNIT 4
med brn clay
lt brn clay
H_2O
Not to scale
Medium brown clayey loam
L. DAMON DEC 81

FIGURE 1

terized by the presence of the following subsurface deposits.

0 to 35 centimeters	- medium-brown clayed loam
35 to 45 centimeters	- dark-brown clay
45 to 58 centimeters	- light-brown clay
below 58 centimeters	- water table

No evidence of the presence of prehistoric cultural deposits was encountered in any of the test units in this segment of the study location.

CONCLUSIONS AND RECOMMENDATIONS

The subsurface archaeological testing program (and additional surface inspection) of the location of CA-Sol-268 has resulted in the following determinations:

- The shallow prehistoric archaeological resource which was recorded in 1977 by archaeologist Eric McGuire has virtually been destroyed, as a result of the various road grading, drainage canal channeling, and agricultural and grazing activities in that area.

  It has been noted that the site was originally reported as a shallow midden site (10 meters x 20 meters), with shell and obsidian flakes present. In 1980, the aqueduct survey resulted in the detection of some obsidian falkes and sparsely occurring shell fragments, and that road grading in the area had badly damaged the site location. The current lack of surface and subsurface archaeological deposits suggest that the site has been destroyed.

- During the course of the testing program it was considered that perhaps the focal point of the archaeological deposits originally recorded by McGuire in 1977, were situated further into the pasture area, to the east. However, thorough surface inspection of that area (up to 100 meters east of the existing drainage canal and fencelines - depicted on Map II), revealed no such surface evidence; therefore, it was concluded that further subsurface testing, east of Units 42 through 52, was not justified.

- The 1980 aqueduct survey report presented a preliminary significance evaluation of the recorded site CA-Sol-268, which determined that the site would likely not be eligible for inclusion on the National Register of Historic Places. The subsurface testing of the site location substantiates that determination, particularly since the site was found to be destroyed. The State Historic Preservation Office in Sacramento has been consulted on this matter, and Mr. Nick Del Cioppo has concurred in these findings (personal communication).

  It is further noted that the lack of diagnostic and/or significant archaeological materials at the site location, leads to the conclusion that regional and local importance of the site parished with the destruction of the resource.

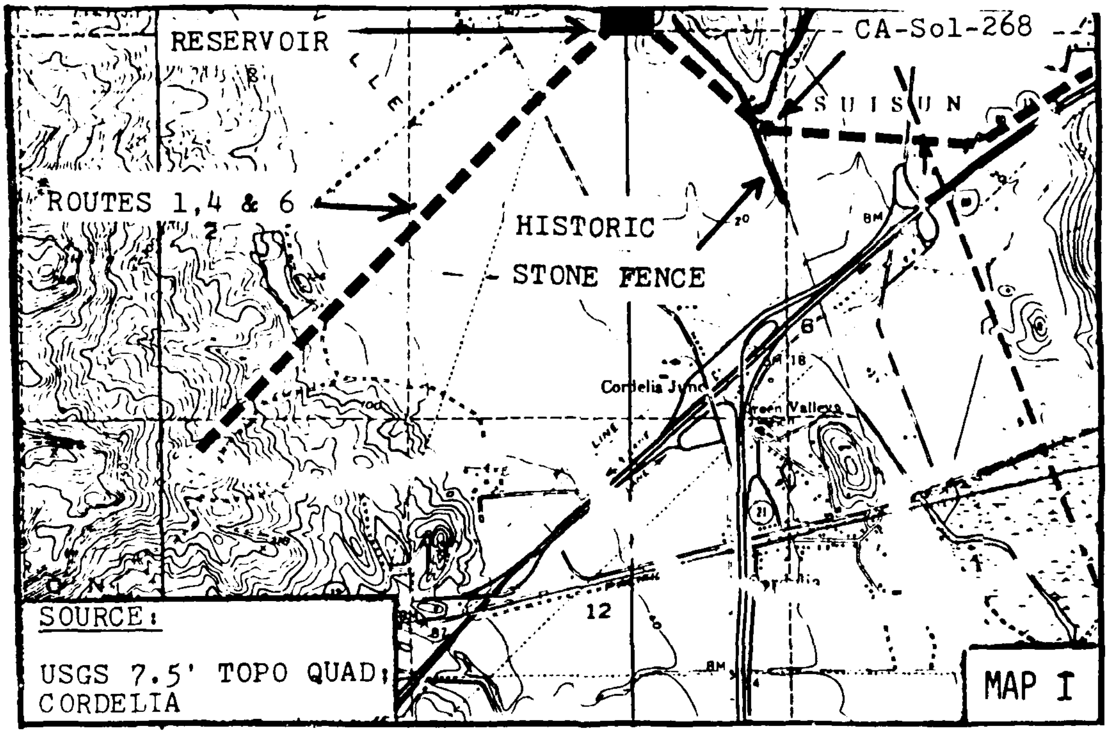
The archaeological investigations at the recorded location of CA-Sol-268, have resulted in the conclusion that potential adverse impacts to archaeological resources at that locale are no longer a critical cultural resources issue, in

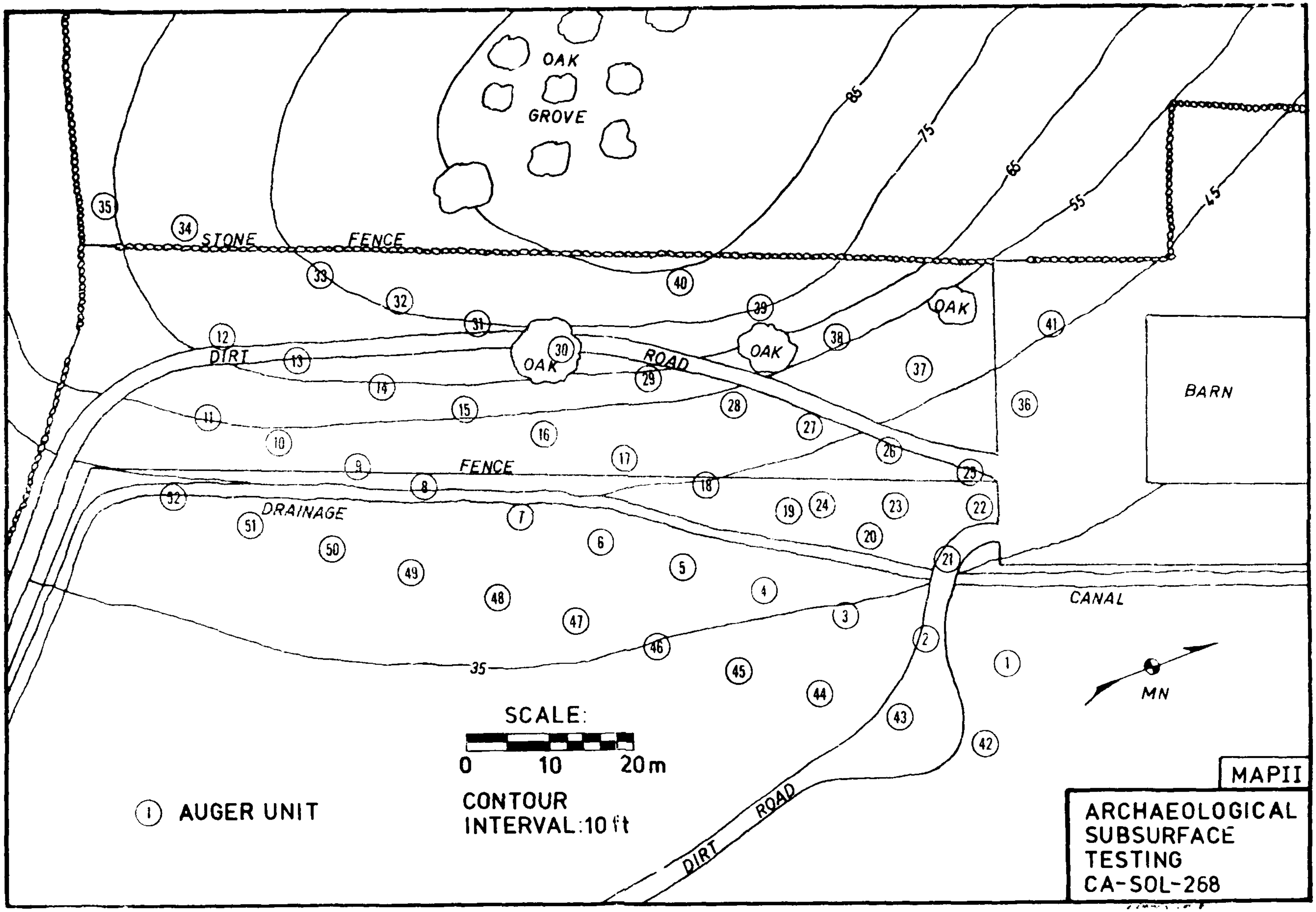
regard to the proposed North Bay Aqueduct Project. The auger testing of the area has lead to the conclusion that no subsurface archaeological deposits exist at that location. Further, close scrutiny of the surface in the overall site locale resulted in the detection of only a very few obsidian flakes, which leads to the conclusion that no archaeological site deposits (obsidian flakes) of sufficient density are present at that locale, to warrant further investigation. Consequently, no further action regarding that location is recommended.

REFERENCES

Chavez, David
1980 Cultural Resources Evaluation of the North Bay Aqueduct Alignment Alternatives (Routes 1, 4 and 6), Solano County, California. Report on File at the State Archaeological Site Survey Regional Office, Sonoma State University. Rohnert Park.

King, T. F., M. J. Moratto, and N. N. Leonard III
1973 Recommended Procedures For Archaeological Impact Evaluation. Published Jointly by the Society of California Archaeology and the University of California. Los Angeles.


RESERVOIR
CA-Sol-268
SUISUN
ROUTES 1,4 & 6
HISTORIC
STONE FENCE
Cordelia Junc
Green Valley
12
SOURCE:
USGS 7.5' TOPO QUAD;
CORDELIA
MAP I


OAK
GROVE
85
75
65
55
45
35
STONE FENCE
FENCE
DIRT ROAD
OAK
BARN
DRAINAGE
CANAL
MN
SCALE:
0 10 20m
CONTOUR
INTERVAL:10 ft
1 AUGER UNIT
MAP II
ARCHAEOLOGICAL
SUBSURFACE
TESTING
CA-SOL-268

APPENDIX V

DRAFT ENVIRONMENTAL STATEMENT/ ENVIRONMENTAL IMPACT REPORT

JUNE 1981

DRAFT

ENVIRONMENTAL STATEMENT/ENVIRONMENTAL IMPACT REPORT

NORTH BAY AQUEDUCT

(Phase II Facilities)

SOLANO COUNTY, CALIFORNIA

Regulatory Permit Application
by the
California Department of Water Resources
Public Notice 12950-58

U. S. ARMY ENGINEER DISTRICT
San Francisco, California

DEPARTMENT OF WATER RESOURCES
CENTRAL DISTRICT
Sacramento, California

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DRAFT

ENVIRONMENTAL STATEMENT/
ENVIRONMENTAL IMPACT REPORT

NORTH BAY AQUEDUCT
(PHASE II FACILITIES)

SOLANO COUNTY, CALIFORNIA

REGULATORY PERMIT APPLICATION
BY THE CALIFORNIA DEPARTMENT OF
WATER RESOURCES
PUBLIC NOTICE 12950-58

U. S. ARMY ENGINEER DISTRICT
SAN FRANCISCO, CALIFORNIA

DEPARTMENT OF WATER RESOURCES
CENTRAL DISTRICT
SACRAMENTO, CALIFORNIA

JUNE 1981

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COVER SHEET
NORTH BAY AQUEDUCT
(PHASE II FACILITIES
SOLANO COUNTY, CALIFORNIA

REGULATORY PERMIT APPLICATION BY
THE CALIFORNIA DEPARTMENT OF WATER RESOURCES
PUBLIC NOTICE 12950-58

(X) DRAFT ENVIRONMENTAL STATEMENT ( ) FINAL ENVIRONMENTAL STATEMENT

Responsible Agencies: U.S. Army Engineer District, San Francisco
211 Main Street
San Francisco, CA 94105

California Department of Water Resources,
Central District
3251 S. Street
Sacramento, CA 95816

Contact Person: Barney Opton
Environmental Resources Planner
Environmental Branch
Corps of Engineers, San Francisco District
(415) 556-0325

1. Name of Action: (X) ADMINISTRATIVE ( ) LEGISLATIVE

2. Authority: Section 10 of the River and Harbor Act of 1899 and Section 404 of the Clean Water Act.

3. Description of Action: The project would divert Sacramento-San Joaquin River Delta water from one of three locations in eastern Solano County overland by pipeline and aqueduct to tie into Phase I aqueduct facilities near Cordelia, California.

4. Environmental Impacts: Possible disruption of biological habitats in the Jepson Prairie and Suisun Marsh that support threatened and endangered plant and animal species; disruption and/or encroachment on prime farmland; temporary disruption of the Fairfield linear park system; possible growth-inducing impacts; consumption of large amounts of energy for construction and during operation and maintenance of the aqueduct; increased noise and dust levels due to construction; generation of large amounts of dredged material from maintenance dredging of intake channels; provision of supplemental water supplies to Solano and Napa Counties.

5. Alternatives Considered: Alternate sources of water including conservation; alternate alignments; no project.

Portions of this report were prepared with the assistance of the following contractors:

Contractor	Contract No.	Amount
Madrone Associates	B-53437	$89,577.80
Griggs and Whitlow	B-53552	4,075.00
F. Thomas Griggs	B-53250	3,500.00
TOTAL:		$97,152.80

ON THE COVER: A surge tank for Phase I facilities of the North Bay Aqueduct stands on a hill above Interstate 80 near Cordelia. This will continue to be a part of the North Bay Aqueduct when Phase II facilities are connected.

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AD-A116 061 CORPS OF ENGINEERS SAN FRANCISCO CA SAN FRANCISCO DI--ETC F/G 13/2
NORTH BAY AQUEDUCT (PHASE II FACILITIES), SOLANO COUNTY, CALIFO--ETC(U)
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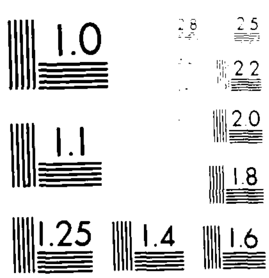


attributed to supplemental water

ect fully consider the environmental

LIST OF TABLES

CONVERSIONS

Parameter	English Unit	English Symbol	Multiply By	To Get Metric Unit	To Get Metric Symbol
Length	inch	in	2.54	centimeter	cm
	foot	ft	0.3048	meter	m
	mile	mi	1.6093	kilometer	km
Area	square feet	ft^2	0.092903	square meters	m^2
	square mile	mi^2	2.590	square kilometer	km^2
	acre	acre	0.40469	hectares	ha
	thousand acres		0.40469	kilohectares	
Volume	gallons	gal	3.7854	liters	L
	cubic yards	yd^3	0.76455	cubic meters	m^3
	acre-feet	AF	1233.5	cubic meters	m^3
	thousand acre-feet		1.2335	cubic hectometers	
	million acre-feet		1.2335	cubic kilometers	km^3
Flow Rates	feet per second		0.3048	meters per second	
	cubic feet per second	cfs or ft^3/s	0.028317	cubic meters per second	
	acre-feet per day	AF/day	1233.5	cubic meters per day	
	gallons per minute	gal/min	0.063090	liters per second	L/s
	million gallons per day	mgd or Mgal/d	43.813	liters per second	L/s
	million gallons per day	mgd or Mgal/d	3785.4	cubic meters per day	m^3/d
Energy	kilowatt hours	kwh	3.60	megajoule	MJ
	British thermal unit	Btu	0.0010551	megajoule	MJ
Miscellaneous	parts per million	ppm	1.00	milligrams per liter	mg/L
	dollars per acre-foot		0.8107	dollars per cubic decameter	
	degrees Fahrenheit	°F	5/9 (F-32)	degrees Celsius	°C
	degrees Fahrenheit	°F	5/9 (F+459.67)	degrees Kelvin	°K
	pounds per square inch	psi	6.8948	kilopascals	kpa

SUMMARY

DESCRIPTION OF PROPOSED ACTION

Pursuant to contracts to deliver State Water Project (SWP) water to Napa and Solano Counties, the Department of Water Resources (DWR) has proposed construction of Phase II facilities of the North Bay Aqueduct, which would supply up to 61,400 acre-feet annually. The aqueduct would divert Delta water from one of three locations in eastern Solano County overland approximately 28 miles to near Cordelia where it would tie into previously constructed Phase I aqueduct facilities in Napa County (see map, Figure i, next page). The City of Vallejo has contracted separately for an additional 5,600 acre-feet of water through its existing intake and transport system on Cache Slough. The Department is also proposing that conservation measures be implemented to reduce water demand.

Background and History

The construction of the North Bay Aqueduct was originally planned for completion in 1966 to ensure delivery to Napa County. Since construction of the Solano County portion of the facility was not deemed necessary until after 1975, an interim supply was provided for Napa County by the Bureau of Reclamation (now Water and Power Resources Service) through the Putah South Canal originating at Lake Berryessa. This supply is delivered to Napa County from the terminus of the Putah South Canal via Phase I facilities of the North Bay Aqueduct, built in 1968.

Construction and Operational Characteristics

Phase I facilities consist of a reservoir and pumping plant near Cordelia in Solano County and an underground pipeline extending about 4½ miles from there to the Napa Turnout Reservoir. The maximum capacity of the Phase I facilities is 46 cubic feet per second (cfs).

The proposed Phase II facilities would be built entirely in Solano County, connecting directly to the existing Phase I facilities. The proposed capacity of the Phase II facilities would permit a maximum flow of 115 cfs during peak water demand periods. The existing Vallejo pumping and transport facilities are capable of a maximum flow of approximately 32 cfs. The proposed Phase II facilities consist of intake pumping plants with fish screens, an open concrete-lined canal, and/or a buried pipeline, and a terminal reservoir.

ALTERNATIVES CONSIDERED

The environmental evaluation of the proposed action to construct and operate the North Bay Aqueduct requires two distinct levels of alternative analysis. Alternative water supply sources for Napa and Solano Counties are first investigated to determine their relative feasibility and likelihood to provide either a complete or partial substitute

for the Delta water supply that would be conveyed by the North Bay Aqueduct.

The second level of evaluation focuses on various alignments of the proposed aqueduct itself. In this report, the seven alternative alignments, which include three possible intake points, are investigated to determine their impacts on cultural resources, particularly the presence of archaeological sites near historic waterways; endangered species and unusual plant associations; vernal pools and the Jepson Prairie, a unique natural feature of eastern Solano County; Suisun Marsh, emphasizing the possible cumulative effect of additional Delta water diversion on salt water intrusion; farmland encroachment; and economic implications, particularly water user costs. The relationship between water supply and population growth in the areas that would be served by the aqueduct is also a special concern in this analysis.

Alternative Supplies

Alternative water supply sources for the two counties include ground water, reanalysis of the Solano Project, desalination of Suisun Slough water, the West Sacramento Valley Canal, conservation and waste water reclamation. In the near future only water conservation and, to a more limited extent, waste water reclamation appear to be feasible alternatives, at least partially, to the proposed North Aqueduct supply. A mixed plan, water conservation with the North Bay Aqueduct and waste water reclamation, is selected as DWR's preferred alternative.* The mixed plan also encompasses any other sources of water supply that may become feasible.

Alternative Alignments

Seven basic alternative alignments were selected for evaluation. Considerations in locating these routes included different intake locations, avoidance of the Jepson Prairie and Suisun Marsh, maximizing the efficiency of secondary water transport systems, and minimizing the disruption of urban areas.

The alternative alignments would divert Delta water from either Cache Slough (Routes 1 and 3), Calhoun Cut (Routes 2 and 2A), or Lindsey Slough (Routes 4, 5, 6, and 7)(see Figure 4-1, page 52). Alternative routes 2 through 7 would have the additional option of terminating at either a North or a South Cordelia Forebay (reservoir). Alternative alignments 2 and 6 propose a segment of open concrete-lined canal with an intermediate pumping station south of Travis AFB. From this pumping plant, Routes 2 and 6 would become a buried 60-inch diameter pipe. All other alternative alignments (1, 2A, 3, 4, 5, and 7) would have a buried 60-inch diameter pipe for the entire length of the aqueduct.

SUMMARY OF SIGNIFICANT BENEFICIAL AND ADVERSE ENVIRONMENTAL EFFECTS OF ALTERNATIVE ALIGNMENTS

Since many of the direct environmental consequences typically associated with construction and operation of water transport facilities are relatively minor, of short duration, and/or largely alleviated by some standard construction measures, the focus is on those impacts which would be relatively significant or distinctly characteristic of a particular alignment.** These include:

---

* Designation of this alternative as "preferred" is not intended to imply any endorsement by the U. S. Army Corps of Engineers. (See note, p. 37)

**Nothing in the table or elsewhere in this report should be taken as implying that some factor or impact has not been considered by the Department of Water Resources in planning the North Bay Aqueduct.

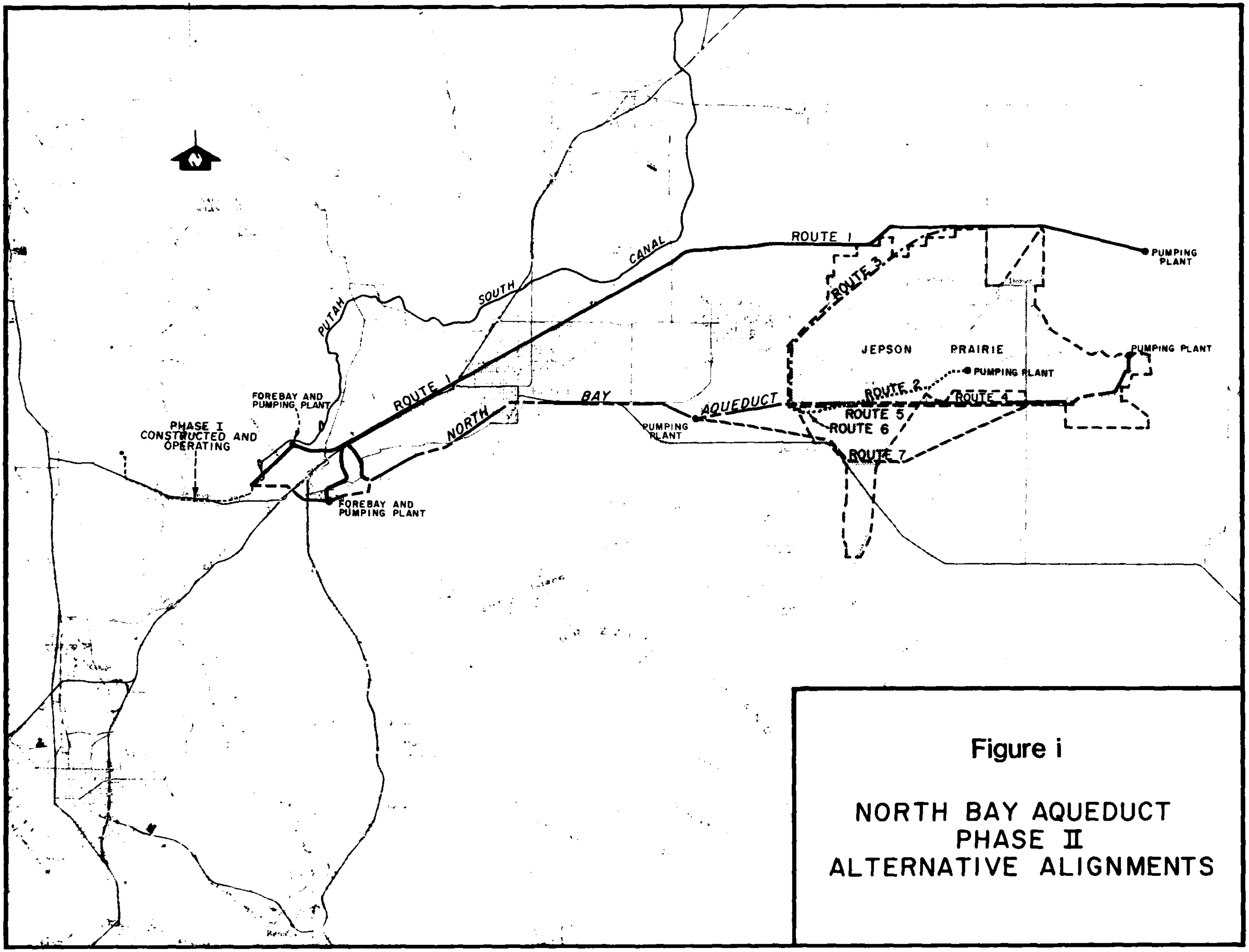


Figure i

NORTH BAY AQUEDUCT
PHASE II
ALTERNATIVE ALIGNMENTS

- Provision of supplemental water supplies to Solano and Napa Counties (All Routes).

- Encumbrance and/or encroachment of prime farmland (All Routes).

- Possible disruption of biological habitats in the Jepson Prairie and Suisun Marsh that support threatened and endangered plant and animal species (Routes 2, 2A, 3, 4, 5, 6, and 7).

- Intersection and disruption of numerous roadways, railroads, and major utility and service lines (All Routes).

- Temporary disruption with the first phase and possibly phases II and III of the Fairfield linear park system along the abandoned Sacramento Northern Railroad right of way (Route 1 only).

- Increased noise and dust levels, particularly in urban areas (All Routes).

- Generation of substantial amounts of material from maintenance dredging of intake channels (Routes 1, 2, 2A, and 3).

- Consumption of a significant amount of energy for construction, operation, and maintenance of the aqueduct (All Routes).

- The pre-treatment water quality of existing domestic supplies in Solano and Napa Counties would be compromised by the supplemental North Bay Aqueduct supply (All Routes).

Since the proposed capacity of the North Bay Aqueduct would be 115 cfs for all alignments, the indirect impacts associated with population growth would be essentially the same for each alignment. The population growth expected in Solano and Napa Counties may be considered to result from or necessitate the North Bay Aqueduct, depending on one's point of view. This growth will result in generally more congested roadways, lowered air quality, elevated noise levels, strains on some public services, diminished open space and wildlife resources, and other ecological effects.

Based on the environmental analysis presented in this report, Routes 1 and 4 (to the North Cordelia Forebay) have been selected as preferred for the construction of the North Bay Aqueduct.* The major advantages of Route 1, with an intake on Cache Slough, would include possible maintenance coordination with the City of Vallejo's existing intake and avoidance of a potential conflict with the proposed relocation of the City of Vacaville's sewage discharge, relatively low construction and operation costs of secondary water transport systems, avoidance of the Suisun Marsh, and expected lower sensitivity with regard to cultural resources and anadromous fish. Significant disadvantages of Route 1 would include encumbrance of prime farmland and temporary disruption of the social environment through a long stretch of Fairfield. Available data also indicate that water quality in Cache Slough is lower than in Lindsey Slough.

Route 4, with the alternative routing around Cordelia Hill to the North Cordelia Forebay, would have the advantage of utilizing the Creed/Robinson Road right of way, thereby minimizing the need for encumbrance of surrounding farmland, minimizing conflicts with utilities along the right of

*The U. S. Army Corps of Engineers takes an impartial position as to whether to issue or deny a regulatory permit until public review is complete. Therefore, the "preferred" alignments referred to in the joint EIR/ES do not represent a Corps designation.

TABLE i

IMPACT OVERVIEW

IMPACTS	AQUEDUCT ROUTES 1	2	2A	3	4	5	6	7
1. Potential seismic events could damage or disrupt the aqueduct.	L	L	L	L	L	L	L	L
2. Soils may cause problems by shrinking and swelling.	-	L	-	-	-	-	L	-
3. Dust and other particulate matter would be generated during excavation activities and could adversely affect urban areas.	M	M	M	M	M	M	M	M
4. Farmland would be encumbered and/or encroached.	M	H	M	M	L	M	H	M
5. Construction of the aqueduct would intersect numerous streams and drainage channels and could also disturb subsurface irrigation and drainage systems.	M	L	L	M	L	L	L	M
6. Construction across existing levees could affect their stability and consequently increase the local flooding hazard.	L	L	L	L	L	L	L	L
7. Initial and maintenance dredging for the aqueduct intake, where required, would temporarily increase turbidity and disrupt riparian vegetation.	M	H	H	M	L	L	L	L
8. Disposal of dredged material would require additional land acquisition and/or transport to landfill.	M	H	H	M	L	L	L	L
9. Fish and other aquatic organisms would be entrained/impinged at the diversion intake.	L	M	M	L	M	M	M	M
10. Construction activities could disrupt native grasslands by removing vegetation and altering the soil strata.	M	H	H	M	L	L	L	M
11. Construction activities would encroach in the primary management zone of the Suisun Marsh.	-	M,-*	M,-*	M,-*	M,-*	M,-*	M,-*	M,-*
12. Construction in the Jepson Prairie and surrounding grasslands would be a potential disturbance to sheep during lambing season.	-	L	L	-	L	L	L	L
13. Areas of relatively high archaeological sensitivity could be revealed during construction of the aqueduct.	L	M	M	M	M	M	M	M
14. Numerous roadways and railroads would have to be traversed during construction of the aqueduct and temporary congestion and rerouting of traffic would result.	H	M	M	M	M	M	M	M
15. Increased noise levels would be associated with construction of the aqueduct, adversely affecting urban areas.	H	M	M	M	M	M	M	M
16. Construction of the aqueduct along Route 1 through Fairfield would temporarily disrupt the first phase of the city's linear park.	H	-	-	-	-	-	-	-
17. Major utility and service lines in Suisun City would be crossed.	-	H	H	H	H	H	H	H
18. Supplemental water supplies would be made available to Solano and Napa Counties.	H	H	H	H	H	H	H	H
19. Although open canal segments of the aqueduct would be fenced along their entire length, some public access to the canal would still occur, endangering the safety of these individuals.	-	M	-	-	-	-	M	-
20. Population growth (particularly around Suisun City and Fairfield) enabled by the additional water supply would result in more congested roadways, lower air quality, elevated noise levels, strains on some public services, diminished open space, wildlife resources, and other ecological effects.	H	H	H	H	H	H	H	H
21. Prime agricultural land in Solano County would be displaced by urban development to accommodate population growth enabled by additional water supply.	H	H	H	H	H	H	H	H
22. Development in Suisun City enabled by the aqueduct water supply could put additional pressure on the adjacent Suisun Marsh.	H	H	H	H	H	H	H	H
23. Intake on Calhoun Cut would conflict with designation as "significant natural resource area" in 1975 Delta Plan.	-	H	H	-	-	-	-	-
24. Pre-treatment water quality of existing domestic supplies would be lowered by supplemental North Bay Aqueduct water supply.	H	M	M	H	L	L	L	L
25. Aqueduct itself or the urban development it allows could cause conflicts with Governor's Urban Strategy.	M	H	H	M	M	M	M	M

NOTE: Relative magnitude of environmental impact is indicated as appropriate: H = High, M = Moderate, L = Low, - = No Impact, * = Unique to alternative routing around Cordelia Hill to North Cordelia Forebay (Routes 2-7)

way, avoiding Suisun Marsh, and reducing potential impacts to the Jepson Prairie, endangered species, and cultural resources. The Lindsey Slough intake for Route 4 would also require minimal initial and maintenance dredging and dredge spoils disposal. The major disadvantages of Route 4 would be the higher construction and operating costs of secondary water transport systems, disruption of the social environment and several major utilities through Suisun City, and a potential conflict with Vacaville's future waste water discharge.

Through public review of this draft environmental document and more detailed analysis of several environmental factors suggested by this study, one preferred route will be selected for inclusion in the final EIR/ES.

1.0 PURPOSE OF, AND NEED FOR PROPOSAL/INTRODUCTION

1.1 PURPOSE AND NEED FOR PROPOSAL

1.1.1 The Department of Water Resources (DWR) is proposing to construct the Phase II facilities of the North Bay Aqueduct to meet the requests of Solano and Napa Counties for additional water supply. DWR's purpose in building the aqueduct would be to fulfill contractual commitments and to satisfy developing needs for supplemental municipal and industrial water in the North Bay region. Various agencies have estimated the amount of supplemental water that the proposed service area will require by the year 2000, and all the estimates indicate a need for some new source of water. /1,2,3/ The aqueduct would convey Delta (State Water Project) water across Solano County, supplying Vacaville, Fairfield, Suisun City, and Benicia. It would also supply Napa by connection to the existing Phase I facilities. The City of Vallejo would also receive a State Water Project supply through its existing pipeline to Cache Slough.

1.1.2 The National Environmental Policy Act of 1969 (NEPA) is the basic national charter for the protection, enhancement, and restoration of the environment. NEPA procedures generally insure that relevant environmental information is made available to public officials and interested citizens before decisions are made and before actions are taken. /4/ Since the North Bay Aqueduct involves construction of an intake structure in "navigable waters of the United States", it requires a permit from the U. S. Army Corps of Engineers (see Section 2.1.1), and thereby is subject to the statutory authority of NEPA. An Environmental Statement (ES) is required.

1.1.3 The California Environmental Quality Act (CEQA) of 1970 (as amended) mandates that all agencies of the State government which regulate activities of private individuals, corporations, and public agencies which are found to significantly affect the quality of the environment shall regulate such activities so that major consideration is given to preventing environmental damage. /5/ Amendments to CEQA Guidelines in 1976 encourage the use of a Notice of Preparation, similar to that already used in federal environmental review procedure. A Notice of Preparation for Phase II of the North Bay Aqueduct was distributed on October 8, 1979.

1.1.4 The preparation and review of an Environmental Impact Report (EIR) is the cornerstone of CEQA. The EIR is considered a full disclosure public document, objectively evaluating all significant environmental implications of a proposed action. EIR Guidelines (Section 15063) specifically encourage the use of a joint EIR/ES where both State and Federal requirements would require preparation of environmental documents.

1.2 BACKGROUND AND HISTORY

1.2.1 The Department of Water Resources (DWR) has contracted with Madrone Associates to conduct an environmental analysis of its proposed action to construct Phase II facilities of the North Bay Aqueduct. The construction of the Phase II facilities would fulfill contractual obligations dating to the 1960's between DWR and the Counties of Napa and Solano. The proposed aqueduct, which would divert Delta water at either

Lindsey Slough or Cache Slough in eastern Solano County, would provide up to 61,400 acre-feet/yr of the total of 67,000 acre-feet/yr contracted for by the two counties. The remainder, 5,600 ac-ft/yr, will be delivered through the existing aqueduct owned by the City of Vallejo, which diverts from Cache Slough.

1.2.2 Plans for supplying water from the Sacramento-San Joaquin Delta to northerly portions of the San Francisco Bay area date back to the 1920s. Although a Solano-Napa County conduit was proposed in 1932, it was not included as an element of the State Water Plan at that northern Bay area. The Legislature formally adopted this recommendation in 1957 and included the North Bay Aqueduct as a feature of the State Water Project.

1.2.3 A lack of interest in the aqueduct by Marin and Sonoma Counties, which had alternative sources of water available (e.g., Russian River), induced a reevaluation of the project which concluded that the focus of the aqueduct should be on Napa and Solano Counties, with construction of the facility to be completed in time to ensure delivery to Napa County by 1966. Since construction of the Solano County portion of the facility was not considered necessary until after 1975, an interim water supply source had to be provided tc Napa County. This interim supply was made available by the Bureau of Reclamation (now Water and Power Resources Service) through its Solano Project facilities originating at Lake Berryessa.

1.2.4. Existing Phase I facilities of the North Bay Aqueduct in Napa County consist of a surge tank near Cordelia with approximately 4 miles of underground 36-inch diameter pipeline extending westerly and terminating at Napa Turnout Reservoir (see Figure 4-1). The maximum capacity of the Phase I facilities is 46 cubic feet per second (cfs). An interim pumping plant near Cordelia currently lifts water from the terminal reservoir of the Solano Project to a surge tank.

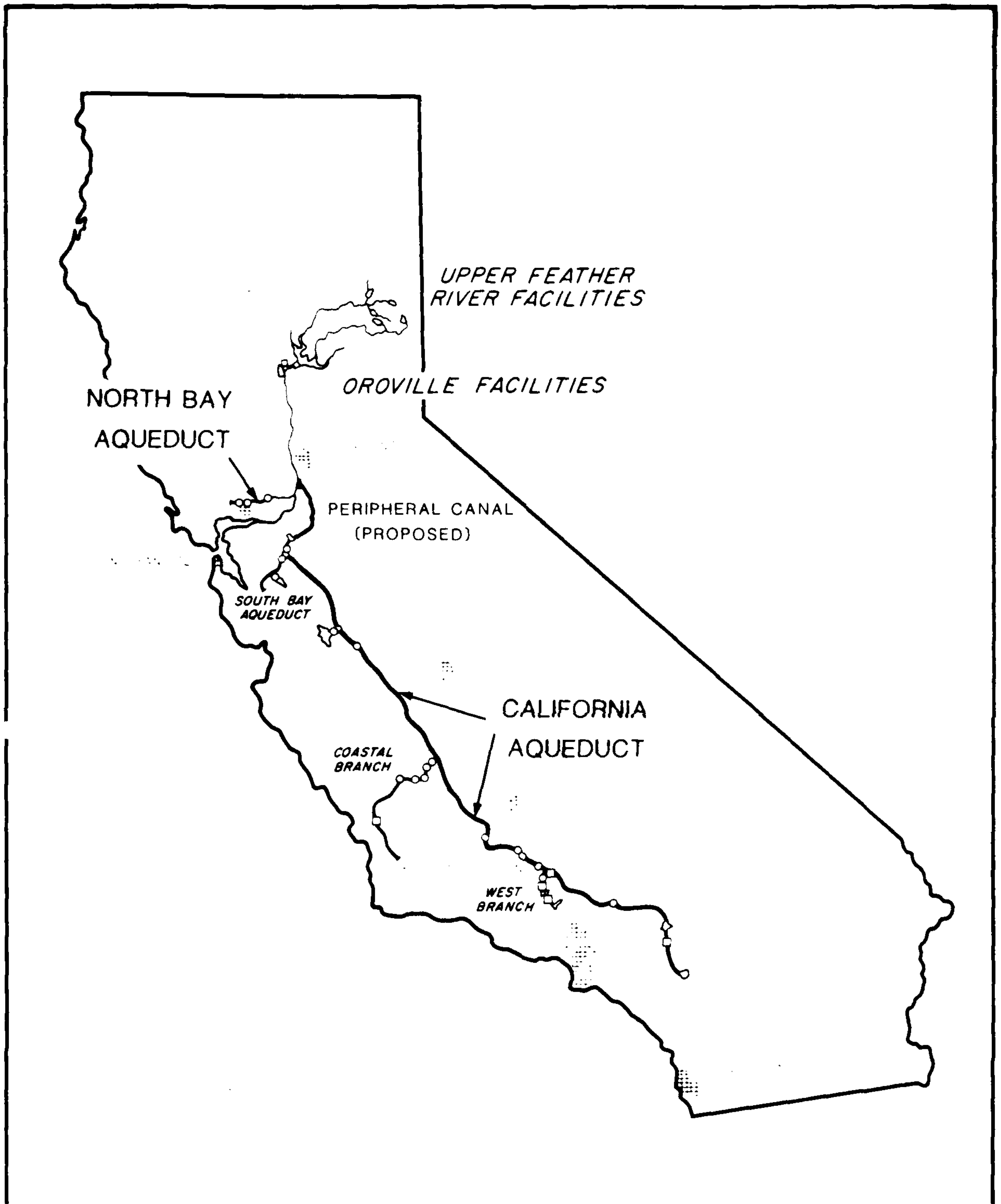
1.3 RELATIONSHIP TO STATE WATER PROJECT

1.3.1 In 1951, the California Legislature authorized construction of what is now the State Water Project, a system designed to provide additional water supply, storage, and distribution throughout California (Figure 1-1). Although the Project has been providing water to portions of California since 1962, the primary facilities of the Project were not completed until 1973. By this time, 18 reservoirs, 15 pumping plants, 5 power plants, and 540 miles of aqueduct were operating in the system. The key feature of the Project is the 770 foot Oroville Dam, which has the capacity to impound over 3.5 million acre-feet of water on the Feather River in Butte County.

1.3.2 The Project, administered by DWR, is scheduled to reach its full delivery capacity of approximately 4.23 million acre-feet sometime after the year 2010. /6/ To enable delivery of this full capacity, DWR has proposed additional reservoirs, ground water storage, a peripheral canal around the Sacramento-San Joaquin Delta, and several water transportation facilities. The North Bay Aqueduct has been proposed to satisfy one of these latter requirements. DWR has also been emphasizing water conservation and waste water reclamation as a means to reduce future water demand and, hence, indirectly supplement more traditional water supply sources.

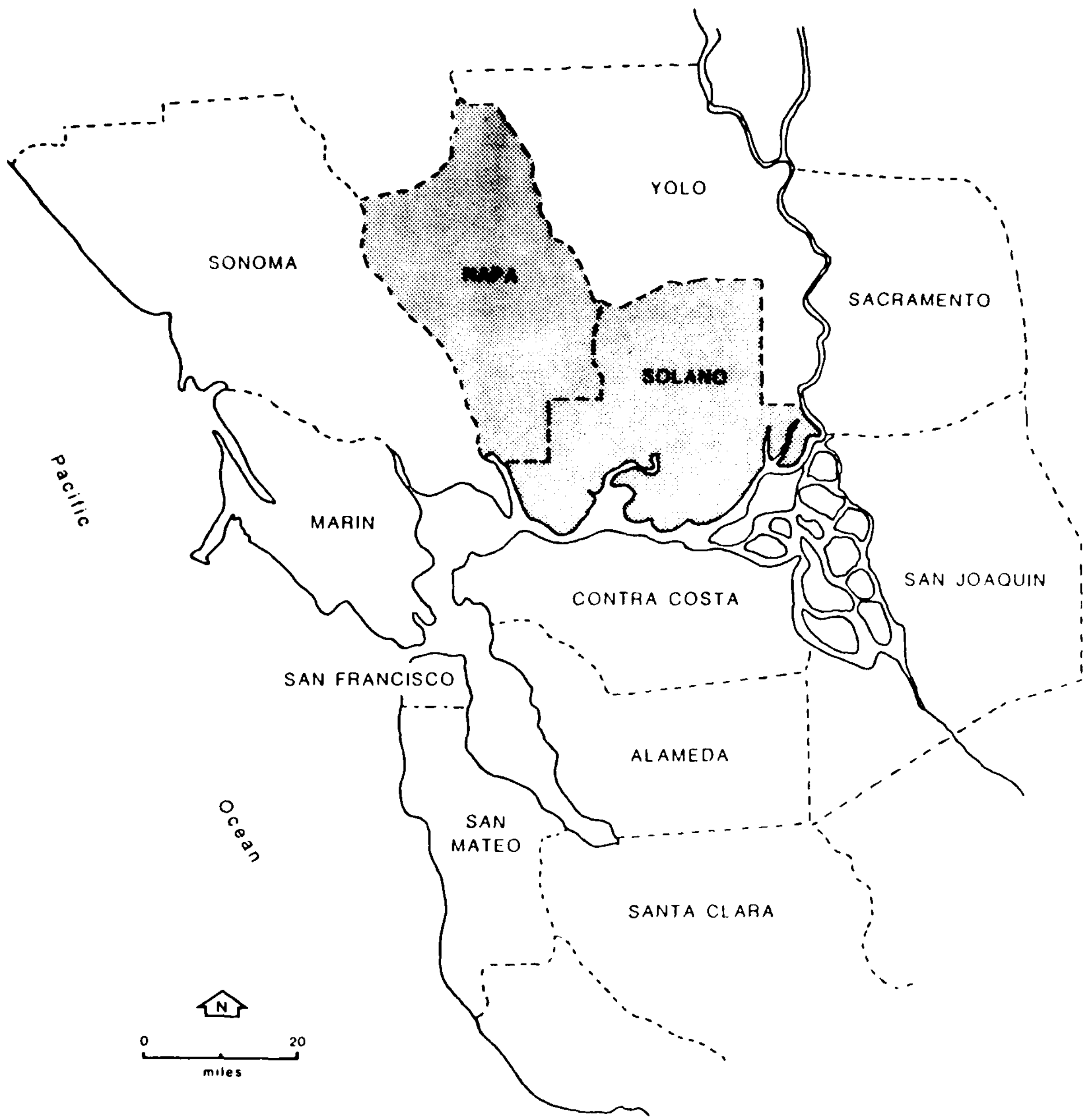
1.4 GENERAL DESCRIPTION OF REGIONAL AREA

1.4.1 Solano and Napa Counties encompass approximately 1,700 square miles between the San Francisco Bay area and the Sacramento Valley (Figure 1-2). Napa County and northeastern Solano County are characterized by the mountainous terrain and narrow valleys of the California



STATE WATER PROJECT

FIG. 1-1



REGIONAL LOCATION

FIG. 1-2

inner Coastal Range. The south and southeastern portions of Solano County consist of gently rolling hills which grade into the flat landscape of the Central Valley. The Sacramento River forms the eastern boundary of the two county area, with the Suisun Marsh and San Pablo Bay to the south and southwest, Sonoma County to the west, and Lake and Yolo Counties to the north.

1.4.2 The population of Solano County, approximately 233,000, is distributed among seven cities and s ttered rural locations. /7/ An estimated 95,000 persons currently reside in Napa County, where a large number of these individuals work outside their counties of residence, commuting to work in places as far as San Francisco and Sacramento. /8/ The majority of the population in both counties resides in the incorporated cities where industry is also concentrated, while the sparsely populated unincorporated regions include agriculture and open space.

1.4.3 Napa and Solano Counties have the mild Mediterranean climate characteristic of central California. A warm, dry season typically extends from May through October while a cool, wet season usually occurs from November to April. Periods of relatively high daytime temperatures frequently occur in the summer, particularly in Solano County, but nights are generally cool. Total annual precipitation varies considerably with the eastern portions of Solano County receiving as little as 17 inches of rainfall each year, while higher elevation locations in eastern Napa County receive up to 40 inches. /9/

1.5 PROBLEM DEFINITION

1.5.1 The environmental evaluation of the proposed action to construct and operate the North Bay Aqueduct requires that two distinct levels of alternatives be analyzed. Alternative water supply sources for Napa and Solano Counties (e.g., water conservation, waste water reclamation, other surface and ground water supplies) must first be investigated to assess their relative feasibility and likelihood of providing either a complete or partial substitute to the Delta water supply that would be conveyed by the North Bay Aqueduct. Section 3.0 in this report addresses alternative water supply sources both individually and as a composite using existing information and quantitative data where they are available and appropriate to support findings.

1.5.2 The second level of the evaluation focuses on various possible alignments of the proposed aqueduct itself. In this report seven alternative alignments, which include three possible intake points, are investigated to assess and compare their primary (direct) environmental effects in Solano County.

1.5.3 Areas of special concern in the analysis of alternative aqueduct routes were identified in a preliminary assessment of the project. They include: cultural resources, particularly the presence of archaeological sites near historic waterways; endangered plant and animal species and unusual plant associations; vernal pools, a distinctive natural feature of eastern Solano County; Suisun Marsh, with respect to direct encroachment into the Marsh and for the possible cumulative effect of diverting additional Delta water on the quantity of Delta outflow, with resultant salt water intrusion into the Marsh; farmland encroachment; and economic implications, particularly costs to water users.

1.5.4 The relationship between water supply and population growth is an issue which has evoked considerable controversy in several other Bay area counties. In conjunction with the analysis of alternative sources of supply, the report evaluates this relationship between new supply and population growth in both Solano and Napa Counties and the secondary effects of growth that might

be attributed to supplemental water supply.

1.6 PURPOSE AND NEED OF EIR/ES

1.6.1 State and Federal law requires that environmental concerns be given major consideration in the review and analysis of proposed public projects and actions. Specifically, the environmental review process requires that all government agencies which have jurisdiction over all or a portion of a proposed project fully consider the environmental implications of the proposed action prior to the issuance of any necessary permits. Agencies with jurisdiction over a project fall into two general categories: those which have actual permit authority, and those which can review and make recommendations only (see Section 2.0). The Environmental Quality Act (CEQA) of 1970 (as amended) and the National Environmental Policy Act (NEPA) of 1969 (as amended) are the two principal pieces of legislation establishing the environmental review process for the proposed North Bay Aqueduct project.

REFERENCES CITED:

/1/ U. S. Bureau of Reclamation (Water and Power Resources Service). January 1979. Four Counties Study: Water Management Opportunities for Lake, Napa, Solano, and Yolo Counties--Status Report.

/2/ Water and Power Resources Service. 1980. Solano County Water Project: A Report on the Feasibility of Water Supply Development, unpublished draft.

/3/ Department of Water Resources. 1980. Water Action Plan for the Southwest Sacramento Valley Service Area.

/4/ Council on Environmental Quality. November 29, 1978. Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act.

/5/ State of California, California Administrative Code, Chapter 3, Guidelines for Implementation of the California Environmental Quality Act (as amended through march 4, 1978).

/6/ Department of Water Resources. November 1979. The California State Water Project - 1978 Activities and Future Management Plans.

/7/ Association of Bay Area Governments. 1979. Projections 79.

/8/ Ibid.

/9/ Solano County Planning Department. 1979. Northern Solano County Surface Runoff Management Plan.

2.0 PLANNING AND REGULATORY CONTEXT

This chapter briefly discusses the agencies having some authority or responsibility in regard to the proposed Phase II facilities of the North Bay Aqueduct.

2.1 FEDERAL

2.1.1 U. S. Corps of Engineers /1/

2.1.1.1 A Corps of Engineers (COE) permit is required for the subject activity pursuant to the provisions of Section 10 of the River and Harbor Act of 1899 (33 U.S.C. 403), and Section 404 of the Clean Water Act (CWA)(33 U.S.C. 1344). Section 10 pertains to the construction of any structure in or over any navigable water of the United States, the excavation from or depositing of material in such waters, the accomplishment of any other work affecting the course location, condition, or capacity of such waters. Section 404 of the CWA pertains to the discharge of dredged or fill material into the waters of the United States at specified disposal sites.

2.1.1.2 The procedures for issuing such permits are governed by Corps of Engineers regulations (33 CFR 320 *et seq.*) and by directives requiring consultation with the U. S. Fish and Wildlife Service, the National Marine Fisheries Service, the Environmental Protection Agency, the California Department of Fish and Game, and other appropriate Federal and State agencies. The decision whether to issue a permit for the North Bay Aqueduct will be based on an evaluation of the probable impact of the proposed project and its intended use on the public interest. The National Environmental Policy Act requires that the Corps prepare an Environmental Impact Statement if it is determined that the issuance of a permit would have a significant effect on the quality of the human environment. In accordance with Corps of Engineers regulations, the evaluation by Section 404 (b)(1) of the CWA has also been integrated into the text of this EIR/ES.

2.1.2 U. S. Fish and Wildlife Service /2/

2.1.2.1 The U. S. Fish and Wildlife Service (USFWS), a division of the Department of the Interior, is responsible for protecting, preserving, and enhancing fish and wildlife resources as specified in the Fish and Wildlife Coordination Act of 1956. Major concerns of this agency for the North Bay Aqueduct include endangered species, associated primarily with the Jepson Prairie vernal pools; migratory birds; and anadromous fish in the intake sloughs. USFWS acts in an advisory role, reviewing permit applications received by the U. S. Army of Engineers (COE). USFWS provides comments and recommendations to COE regarding impacts of proposed projects on fish and wildlife resources and measures considered necessary to prevent and mitigate project-related losses of fish and wildlife resources.

The Endangered Species Act of 1973, as amended, is also administered by USFWS. The Act requires the Corps of Engineers, in consultation with the USFWS, to insure that proposed projects are not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction of adverse modification of critical habitat for such species, unless an

exemption of the project has been granted by the Endangered Species Committee established by the Act.

2.1.3 National Marine Fisheries Service /3/

2.1.3.1 The National Marine Fisheries Service (NMFS), within the U. S. Department of Commerce, is primarily concerned with the preservation and management of marine, estuarine, and anadromous fish, as specified by the Fish and Wildlife Coordination Act. NMFS functions in an advisory role (similar to the USFWS), reviewing and commenting on permit applications submitted to the Army Corps of Engineers. Regarding the North Bay Aqueduct project, NMFS has expressed particular concern over the cumulative impacts of water diversions from the Delta on the biota of the Delta, Suisun Marsh, San Francisco Bay, and the continental shelf.

2.1.4 U. S. Environmental Protection Agency /4/

2.1.4.1 The U. S. Environmental Protection Agency (EPA) is the agency responsible for establishing the guidelines that must be met by Corps of Engineers permits under Section 404. EPA concerns are focused on the protection of water quality, wetlands, fisheries, and wildlife habitat. They are also interested in the investigation of alternative water supply sources in Napa and Solano Counties.

2.1.5 U. S. Air Force (Travis Air Force Base) /5/

2.1.5.1 If any part of the North Bay Aqueduct were to be located on Air Force Base property, an easement would be required. If the aqueduct passed through a government-owned easement, then a consent agreement would be required. The only current restriction on siting of the North Bay Aqueduct on Air Force Base property requires that any aqueduct facilities crossing the Air Force Base would have to be placed underground.

2.1.5.2 The Air Force base has established a restricted zone around its runways which governs the height of buildings and other structures. The restrictions prohibit any above-ground structures for a 50-foot parallel and 1,000-foot perpendicular distance from the end of the runways. Beyond this area the height of above-ground structures can increase at the rate of one foot per 50-feet parallel and one foot per 7 feet perpendicular to the end of the runway.

2.1.6 Department of Energy /6/

2.1.6.1 The U. S. Department of Energy will require a permit for crossing overhead electrical transmission lines located in the eastern portion of the project site.

2.2 STATE

2.2.1 Department of Water Resources

2.2.1.1 The Department of Water Resources (DWR is proposing the construction of the Phase II facilities of the North Bay Aqueduct to fulfill existing water supply agreements with Solano and Napa Counties. The Department is coordinating the environmental review process and obtaining all necessary permits. DWR is acting as a lead agency and is responsible for making sure that all applicable provisions of the California Environmental Quality Act are met.

2.2.2 San Francisco Bay Conservation and Development Commission /7/

2.2.2.1 A Bay Conservation and Development Commission (BCDC) permit would be required for any North Bay Aqueduct alignment falling within the primary management zone of the Suisun Marsh. BCDC has requested the U. S. Army Corps of Engineers to hold its permit in abeyance until a BCDC permit is issued. The Commission would allow a buried pipeline to cross the primary management zone of the marsh, provided that complete restoration of disturbed areas occurs, unless a feasible alternative routing is available. BCDC has delegated its authority in the secondary management zone of Suisun Marsh to Solano County and would have direct involvement only upon appeal. BCDC is concerned with losses in wildlife habitat, effects on endangered species, cutting the marsh off from upland areas, and interfering with terrestrial migrations of wildlife during the construction phase.

2.2.3 California Department of Fish and Game /8/

2.2.3.1 The California Department of Fish and Game (DFG) has responsibility for protecting and managing fish and wildlife species. Since all of the proposed alignments of the North Bay Aqueduct would cross several streams, DFG permits would have to be acquired under the stream alteration agreement of the Fish and Game Code. In addition State law mandates that new water diversion must have a screened intake point, requiring a DFG permit.

2.2.4 California Health Services /9/

2.2.4.1 The California Health Services agency has jurisdiction which includes all domestic water utilities. Therefore, the North Bay Aqueduct project would be subject to its rules and regulations. Although no permits are required by Health Services, they would be responsible for setting standards for treatment of the water. Their primary concern with the North Bay Aqueduct project is that the City of Vallejo receives an improved water source.

2.2.5 State Parks and Recreation /10/

2.2.5.1 The State Parks and Recreation Department does not have any permit or regulatory authority over the North Bay Aqueduct project; however, it has notified DWR that part of the Jepson Prairie that would be crossed by some of the alternative aqueduct alignments is included in its future acquisition program.

2.2.5.2 The Department has indicated a preference for the Route 1 alignment which would completely avoid the Jepson Prairie. It has further stipulated that mitigation land purchases of up to 3,000 acres of the Jepson Prairie (the maximum required if Route 2 or 2A were selected) would be requested to offset potential impacts to the sensitive region. If Route 4, 5 or 6 is selected, the Parks and Recreation Department has suggested that geology test borings be drilled along Creed Road prior to construction to determine the possible effects of aqueduct construction on ground water movement.

2.2.6 State Water Resources Control Board /11/

2.2.6.1 State Water Resources Control Board (SWRCB) permits for appropriative water rights were obtained by Department of Water Resources in 1967 for the entire North Bay Aqueduct project; however, not all of the terms and conditions of the permit have been finalized.

2.2.6.2 SWRCB is primarily concerned with possible conflicts in Cache Slough if Vacaville continues to discharge waste water into a tributary creek and North Bay Aqueduct selects an intake

point downstream. It has indicated support of a North Bay Aqueduct alternative that intakes on Cache Slough, since Vallejo currently has an intake there.

2.2.7 Regional Water Quality Control Board /12/

2.2.7.1 Although a discharge permit would not be required for the North Bay Aqueduct project, the Central Valley Regional Water Quality Control Board will review the Draft EIR/ES through the State Clearinghouse and comment on the possible impact of other projects and their alternatives on the North Bay Aqueduct and on the impact the North Bay Aqueduct might have on other projects in the area. The Regional Board's principal concern is the possible conflict between the City of Vacaville, which discharges waste water into Alamo Creek (a tributary of Cache Slough), and the placement of the North Bay Aqueduct intake downstream.

2.2.8 California Department of Transportation /13/

2.2.8.1 The California Department of Transportation (CALTRANS) has responsibility for the design, construction and maintenance of the State highway system. District 10 is responsible for the State highway system in Solano County and is therefore interested in the portions of State Highway 12, Interstate 80, and Interstate 680 that may be affected by the North Bay Aqueduct project. For crossing an Interstate of State highway, an encroachment permit would be necessary, setting forth the requirements of the facility within the highway right of way.

2.2.9 The Reclamation Board /14/

2.2.9.1 The Reclamation Board, a division of the State Resources Agency, has jurisdiction with respect to levee maintenance on Cache and Lindsey Sloughs. A permit to alter existing levees on these sloughs would be required for the construction of the North Bay Aqueduct.

2.2.10 State Lands Commission /15/

2.2.10.1 For the North Bay Aqueduct, DWR must submit to the State Lands Commission (SLC) a "Notice of Proposed Use of State Lands". The SLC will review DWR's notices and advise DWR of any known, existing, or proposed facilities which may be in conflict with DWR's planned use. SLC will also recommend to DWR any restrictions or limitations on DWR's use of the State lands which it deems necessary for the health and safety of the public trust or preservation of natural resource values and protection of the environment.

2.3 LOCAL

2.3.1 Although State activities supersede local agency jurisdictions, exempting them from obtaining regularly required permits, State agencies generally attempt to comply with local regulations as much as possible. The local agencies whose jurisdictions would be affected by construction and operation of the North Bay Aqueduct include the Planning, Public Health and Public Works Departments of Solano County, Napa County, City of Fairfield, City of Vacaville, Suisun City, City of Benicia, City of Vallejo, City of Napa, as well as various special districts (e.g., Napa and Solano County Flood Control and Water Conservation Districts, Solano County Mosquito Abatement, Solano Irrigation District). In the event that a proposed alignment crossed through a secondary management zone of Suisun Marsh, the Solano County Board of Supervisors would have to grant approval.

REFERENCES CITED:

/1/ Personal communication. Lewis, Barney. U. S. Corps of Engineers.

/2/ Personal communication. Michny, Frank. U. S. Fish and Wildlife Service.

/3/ Personal communication. Yocum, Tom. National Marine Fisheries Service.

/4/ Personal communication. Yunker, Eric. Environmental Protection Agency.

/5/ Personal communication. Ronaldue, John. Travis AFB.

/6/ Letter from Anderson, John D. U. S. Department of Energy. Assistant Area Manager for Engineering, to Madrone Associates. April 17, 1980.

/7/ Personal communication. Batha, Bob. San Francisco Bay Conservation and Development Commission.

/8/ Personal communication. Rollins, Glen. California Department of Fish and Game.

/9/ Personal communication. McMillan, Mr. California Health Services.

/10/ Personal communication. Meyer, Frederick. State Parks and Recreation and memo from Dick Kretsinger and Wayne MacRostie to Ed Whisman, Department of Water Resources, March 4, 1980.

/11/ Personal communication. Johns, Jerry; Halpt, Jim; Meyer, Harry. State Water Resources Control Board.

/12/ Personal communication. Vaughn, Greg. Regional Water Quality Control Board.

/13/ Personal communication. Carol, Ray; Smith, R. B. California Department of Transportation, District 10.

/14/ Personal communication. Allen, Ted. The Reclamation Board.

/15/ Personal communication. Reese, Mr. State Lands Commission.

3.0 WATER NEEDS AND ALTERNATIVES

3.0.1 This chapter examines the broad range of reasonable water supply alternatives (including the North Bay Aqueduct Delta water supply alternative) which could meet the future supplemental water needs of Solano and Napa Counties. The principal components of each water supply alternative are described along with each alternative's general environmental, technical, and economic considerations and implications. Table 3-1 presents a summary evaluation of water supply alternatives. Also discussed are a mixed program of water supply alternatives and the "No Project" alternative.

3.0.2 Section 3.1 compares existing and future water supply sources with projected water demand in Solano and Napa Counties over the next 20 years. Section 3.2 provides a description and evaluation of various water supply alternatives having the potential to satisfy future water demands. Section 3.3 presents a discussion of the "No Project" alternative, as required by both State and Federal environmental regulations. Section 3.4 gives the selection of a preferred alternative.

3.0.3. U. S. Army Corps of Engineers' regulations require that all alternatives considered in an environmental report be identified under four possible categories. The categories are: 1) within the capability of the applicant (DWR) and within the jurisdiction of the Corps; 2) within the capability of the applicant but outside the jurisdiction of the Corps; 3) reasonably foreseeable, beyond the capability of the applicant but within the jurisdiction of the Corps, and 4) reasonably foreseeable, and both beyond the capability of the applicant and outside the jurisdiction of the Corps. These categories of alternatives are indicated by the number in parentheses following each alternative title in this chapter.

3.1 SUPPLEMENTAL WATER NEEDS*

Municipal and industrial demand for water is expected to exceed supply in both Solano and Napa Counties before 1990, as Table 3-2 indicates. By 2000, shortages could be considerably more severe. The imbalance between demand and supply could be corrected by measures to increase supply or reduce demand. Several such measures are outlined in the remainder of this chapter.

3.2 WATER SUPPLY ALTERNATIVES

3.2.1 DELTA WATER SUPPLY ALTERNATIVES

3.2.1.1 North Bay Aqueduct (Proposed Project) (1)

3.2.1.1.1 A Delta water supply alternative involves the construction of an overland transport system using Sacramento-San Joaquin Delta (State Water Project) waters as the basic source of supply. This alternative is exemplified by the proposed North Bay Aqueduct project (see Chapter 4).

3.2.1.1.2 The environmental, cost and technical implications of the North Bay

*The demand forecasts in this chapter are based partly on Department of Finance E-150 series population projections. Both higher and lower projections are available. The latest projections for Solano and Napa Counties, which take into account the 1980 Census, total somewhat higher than the E-150's, but the difference was not considered significant for estimating water demand.

TABLE 3-1

WATER SUPPLY EVALUATION SUMMARY

WATER SUPPLY ALTERNATIVE	YEAR 2000 TOTAL WATER SUPPLY Solano (ac-ft/yr)	YEAR 2000 TOTAL WATER SUPPLY Napa (ac-ft/yr)	YEAR 2000 M & I ADDITIONAL WATER SUPPLY Solano (ac-ft/yr)	YEAR 2000 M & I ADDITIONAL WATER SUPPLY Napa (ac-ft/yr)	COMMENTS
Delta Water Supply, i.e., North Bay Aqueduct	42,000	25,000	42,000	25,000	Full contractual deliveries.
Groundwater Supply Development	106,000-159,700	10,000-20,000	Potential for up to 16,000 acre-feet/year.	0	Practical considerations (i.e., need for collection and transportation system) and institutional constraints will substantially limit the degree to which this alternative can satisfy M & I requirements.
Desalination of Suisun Slough	25,000?	0	25,000?	0	Requires study.
Solano Project Reanalysis	20,000	0	Theoretically 20,000 if made available for M & I users.	0	Still under study. Institutional constraints and discrepancies in the amount of water actually available reduce feasibility of this alternative.
West Sacramento Valley Canal	148,000-350,000	7,500	Would depend on portion of total supply available for M & I use.	7,500	Ample water supply but not feasible before year 2000.
Water Conservation Program	11,040*	5,091*	11,040*	5,091*	This alternative has the added benefit of energy savings. Full implementation of suggested water conservation program would require a number of local regulatory actions.
Wastewater Reclamation	10,000-60,000	1,000-7,500	6,000 - ?	0	Feasibility depends on a variety of economic, public health, and institutional constraints.
Mixed Supply	42,000	25,000	42,000	25,000	Could include all above alternatives with possible exception of West Sacramento Canal. North Bay Aqueduct could be full size or smaller.

*Demand reduction in these amounts equates to additional water supply.

TABLE 3-2

FUTURE DEMAND AND SUPPLY
FOR MUNICIPAL AND INDUSTRIAL WATER IN SOLANO AND NAPA COUNTIES

	(1) Demand[1/] (ac-ft/yr)	(2) Supply[1/] (ac-ft/yr)	Supplemental Water Requirement, (1)-(2) (ac-ft/yr)
Solano County:			
1990	66,270	55,940	10,330
2000	77,350	55,940	21,410
Napa County:			
1990	24,000	18,240	5,760
2000	28,200	18,240	9,960
Total, Both Counties:			
1990	90,270	74,180	16,090
2000	105,550	74,180	31,370

[1/] Source: Department of Water Resources, "Water Action Plan for the Southwest Sacramento Valley Service Area," 1980. Per capita water use at "conservation" rates. For underlying assumptions, see Appendix G. Figures converted from cubic dekametres (dam^3). (ac-ft = .8107 dam^3).

Aqueduct Delta Supply alternative are examined in later chapters. General environmental concerns include possible adverse impacts resulting from construction activities (particularly in environmentally sensitive areas), encroachment on farmland, and possible growth inducement. A recent study concluded that the present State Water Project (SWP) yield would be insufficient to satisfy all its contractual commitments. Therefore, the completion of the North Bay Aqueduct would increase the stress on the State Water Project. /1/ In the event of a water shortage, the SWP's agricultural customers may receive up to a 50 percent cut in entitlement deliveries before M&I customers receive any cut. If further cuts are required, deliveries to all contractors are reduced in equal proportions.

3.2.1.1.3 The water supply capability and estimated delivery schedule for the North Bay Aqueduct are found in Section 4.1. At maximum capacity the project would deliver 42,000 acre-feet/year of Delta water to Solano County (5,600 acre-feet/year through Vallejo's existing system) and 25,000 acre-feet/year to Napa County. Since Napa County is currently receiving an interim supply of

7,500 acre-feet/year from Lake Berryessa, the North Bay aqueduct project would actually provide Napa County 17,500 acre-feet/year of additional water over existing supply, at maximum delivery.

3.2.1.2 Enlarged North Bay Aqueduct Project (1)

3.2.1.2.1 A variation on the North Bay Aqueduct project would be an enlarged North Bay Aqueduct concept. This alternative would provide a combined conveyance system with sufficient capacity to convey Delta water supplies for both the contracted Napa and Solano County amounts as well as additional capacity to provide water for salinity control in Suisun Marsh. The concept more specifically involves combining the 550 cfs capacity of the proposed Denverton Channel (a diversion which would convey Delta water from Lindsey Slough to Denverton Creek, a tributary to Montezuma Slough) and the projected 115 cfs capacity of the North Bay Aqueduct into a single conveyance system as far as the terminus of the Denverton Channel. /2/ The combined facilities would eliminate the need for a pump lift and reduce right of way requirements as well as construction and operation costs.

3.2.1.2.2 This alternative would not increase delivery of North Bay Aqueduct water to Napa and Solano County water contractors but would combine domestic and agricultural water supply with water supply for water quality control in Suisun Marsh. Thus, it would have the same effect on the future M&I water supply-demand balance as the currently proposed North Bay Aqueduct project. Development of this alternative is still under study and will depend both on a proven need for additional water quality control in Suisun Marsh as well as on final determination of an alignment for the North Bay Aqueduct.

3.2.2 OTHER SUPPLY SOURCES: SURFACE AND GROUND WATER

3.2.2.1 Other than the Delta supply concept exemplified by the North Bay Aqueduct, sources of supplemental water supply for Napa and Solano Counties include ground water, Lake Berryessa, Suisun Slough (with desalination), and the West Sacramento Valley Canal.

3.2.2.2 Ground Water Supply Development (2)*

3.2.2.2.1 Solano County. Solano County has two major hydrogeologically separated ground water reservoirs -- the Suisun-Fairfield Valley and the Putah Plain aquifers. Current safe ground water supply estimates in the County range from 106,000 to 159,700 acre-feet/year. /5,6/ On the basis of ground water pumpage records for 1963-1975, approximately 143,700 acre-feet of ground water are used in an average year. This indicates that, at best, only about 16,000 acre-feet per year is presently available for use. The safe ground water supply could be expected to increase beyond the year 2000 due to the growth of agricultural, municipal, and industrial use, with a corresponding increase in ground water recharge.

3.2.2.2.2 In Solano County, ground water supplies are primarily used for agricultural irrigation, although some local municipalities (e.g., Vacaville, Dixon, and Rio Vista also rely on ground water for domestic supply). Ground water is used primarily during the summer months when water demand is high and surface supplies (i.e., Solano Project) are reduced. As demand for ground water increases, conflicts between peak domestic (M&I) use and agricultural requirements will become more apparent.

*This alternative could be developed by DWR and/or local agencies.

3.2.2.2.3 A major constraint to the use of ground water supplies for M&I use is the variable quality of ground water in the Suisun-Fairfield area, where most water demand would occur. Ground water salinity levels in the Suisun-Fairfield area typically range from 300 to 6,000 mg/l Total Dissolved Solids (TDS), with average values generaly exceeding 900 mg/l TDS. /7/ Putah Plain ground water is of somewhat better quality, with average TDS levels generally under 600 mg/l. However, the Putah Plain aquifer is distant from M&I water demand centers in central and southern Solano County, so water transport facilities would have to be incorporated into any project developing ground water on a major scale. Although the Putah South Canal apparently has the capacity to accommodate additional water flows, downstream water quality agreement would prohibit the use of the Canal for transporting ground water.

3.2.2.2.4 Consequently, even though 1977 costs for pumping ground water locally were $15.50/acre-foot in the Putah Plain area, the additional costs of a water transport system would be expected to be substantial, reducing the overall attractiveness of ground water supplies for M&I use. /8/ Although ground water pumping costs in the Suisun-Fairfield area are higher ($20/acre-foot in 1977), distribution costs would be lower than in the Putah Plain because of the proximity to the Fairfield population center. However, the typically poor water quality reduces the desirability of this possible source of M&I water.

3.2.2.2.5 It has been estimated that the use of ground water in conjunction with surface supplies (e.g., the Solano Project) could increase average ground water yield by 20,000 acre-feet/ year. /9/ This would be achieved by drawing more heavily on surface supplies in the wet months and switching over to ground water in dry months. However, the costs associated with the required system to distribute ground water to the same area as the surface water could be so high as to make such a plan economically infeasible. /10/ In addition, ground water resources are largely under the control of private interests and enforcement of any conjunctive use plan would be difficult.

3.2.2.2.6 Although knowledge of Solano County's ground water basins is incomplete, it appears from current information that a maximum of 16,000 acre-feet per year is available for use. However, most of this additional ground water would not be available for domestic use because of water quality limitations, institutional constraints, and collection system costs. Even though future increases in importation of surface water could lead to increases in ground water basin recharge, and hence the safe water supply of this resource, increased agricultural efficiency could also reduce basin recharge.

3.2.2.2.7 <u>Napa County</u>. In Napa County usable ground water storage capacity is restricted to the area between Napa and St. Helena, with an estimated range in safe yield of 5,500-28,150 acre-feet per year. /11,12/ North of St. Helena ground water quality is generally poor. South of Napa ground water is frequently degraded by brackish water from San Francisco Bay. Safe supply is generally restricted to low-yield wells. Between 1966-75, ground water pumpage, primarily for agricultural irrigation, was estimated at 10,000 acre-feet annually, resulting in a net overdraft of 91 acre-feet a year. Computed cost of ground water pumping for irrigation in Napa Valley in 1976 was $38/acre-foot without sprinkler systems. /13/

3.2.2.2.8 As in Solano County, knowledge of Napa County ground water conditions is incomplete. The increase in total water demand for Napa County is projected at only about 4,600 acre-feet by the year 2000. An 11,000 acre-foot increase in M&I demand is projected to offset declining agricultural demand. Thus, even a small increment of ground water supply development has the potential for satisfying a significant portion of any supplemental water needed. Most

of the additional demand would be for M&I use, however, so water quality as well as quantity considerations could be crucial to determining the role of ground water supplies in meeting future M&I water demand. In addition, the expense for a system to widely collect and distribute a relatively small amount of ground water for M&I use would be considerable. Consequently, ground water supplies in Napa County are expected to continue to be used as a supplemental local source, principally for agricultural use rather than M&I use.

3.2.2.3 Solano Project Reanalysis (4)

3.2.2.3.1 The Federal Solano Project, built in the 1950s, includes Monticello Dam, Lake Berryessa, Putah South Canal, and other related facilities. The U. S. Water and Power Resources Service (formerly U. S. Bureau of Reclamation) supplies water to Solano County through the Solano County Flood Control and Water Conservation District, which sells the water to member agencies such as the cities of Fairfield, Vacaville, and Vallejo, and agricultural water users such as the Solano Irrigation District. At present, minimum contract entitlements are 14,200 acre-feet/year for municipal water use and 161,200 acre-feet/year for agricultural use. /14/ However, in the water year ending on February 29, 1980, municipal water use in the County was 28,536 acre-feet while agricultural use was 167,462 acre-feet.

3.2.2.3.2 A recent study has concluded that the present operation of the Solano Project could be modified to increase the average annual water supply. /15/ This could be done by increasing the firm project yield, at the risk of slightly greater chance that the yield could not be fully met during a dry period. For example, the present firm yield of the Solano Project to the Putah South Canal service area of 201,000 acre-feet carries with it 93 percent certainty that this yield can be met throughout the next 70 years. If the yield were increased to 214,000 acre-feet, the certainty of meeting this yield with no deficiencies in the next 70 years is about 86 percent. In other words, increasing the annual yield during normal periods increases the chance of minor cutbacks in dry periods. However, a major difficulty with the assumption of a reanalysis is that in the 1980 water year Solano County Flood Control and Water Conservation District scheduled and received advance payment from its member agencies for the delivery of 216,367 acre-feet. /16/

3.2.2.3.3 The final outcome of the Solano Project reanalysis is uncertain at this time. Review of the reanalysis concept is currently in process by the Water and Power Resources Service.

3.2.2.4 Desalination of Suisun Slough Water (1)*

3.2.2.4.1 Desalination (desalting) of Suisun Slough water is another potential source of supplemental water supply for the project area. Suisun Slough is close to the areas of water need in central Solano County, and the brackish water it contains may be suitable for desalting to provide municipal and industrial water supply. Other than a brackish water source, the principal requirements for desalting are a source of electrical power and a way to dispose of waste brine.

3.2.2.4.2 DWR is now in the process of building a pilot plant to desalt brackish agricultural drainage water in the San Joaquin Valley by reverse osmosis. The total concentration of mineral constituents in the San Joaquin Valley agricultural drainage water (5,000 to 10,000 ppm TDS) is comparable to the concentration in Suisun Slough, but individual constituents vary. The

*This alternative is within DWR's capability as long as local agencies contract for repayment of the facility.

pilot plant will have capacity to produce one million gallons a day of desalted water. Once procedures have been refined in the pilot project, DWR plans to build a commercial scale 25-million-gallons-a-day plant that could provide an increment to SWP yield. /17/ Cost of the product water is expected to be about $300/acre-foot in 1981 dollars. /18/ About 40 percent of this cost would be for electrical power; the larger plant would require an estimated 80 million kWh per year, which is equal to the electrical power needs of about 15,000 average California residences.

3.2.2.4.3 Waste brine from a desalting plant on Suisun Slough (approximately 1 to 1-1/2 gallons of it for each 10 gallons of desalted water the plant produces) might be disposed of by a pipeline to the Carquinez Strait (about 16 miles).

3.2.2.4.4 Special studies, requiring several years, would be required to evaluate the feasibility of desalting as a source of significant water supply to the proposed North Bay Aqueduct service area. High costs and energy requirements make this supply unlikely.

3.2.2.5 <u>West Sacramento Valley Canal</u> (3)

3.2.2.5.1 The Water and Power Resources Service is studying the feasibility of a West Sacramento Valley Canal Unit which could deliver additional water directly to both Solano and Yolo Counties and, by exchange, to Lake and Napa Counties. The proposed 30-mile-long canal would connect the Tehama-Colusa Canal -- now under construction and planned to end at Bird Creek in Yolo County -- to the Putah South Canal. /19/

The allocated supply of the Tehama-Colusa canal to the service area, primarily in Yolo and Solano Counties, is 148,000 acre-feet a year. To meet peak demand, the Tehama-Colusa Canal would have to be extended 3.2 miles to Oat Creek, where a reservoir would be constructed. A study of the 1976-77 drought may result in reduction of the allocation. /20/ An additional yield of 155,000 acre-feet could be available with the construction of an off-stream reservoir near Sites to store surplus Sacramento River floodflows.

3.2.2.5.2 The West Sacramento Valley Canal is not likely to be built before the year 2000. /21/ A new feasibility study on the project is scheduled for completion in 1981.

3.2.3 CONSERVATION AND WASTE WATER AS SUPPLEMENTAL SUPPLY SOURCES

3.2.3.1 <u>Water Conservation</u> /2/ *

3.2.3.1.1 Steps to increase water conservation act to directly reduce water demand, thereby making existing supplies last longer or serve more people. Water conservation offers the greatest potential for increasing effective water supply of any nonstructural alternative and is therefore discussed in somewhat greater detail than other alternatives.

3.2.3.1.2 To be a useful alternative for meeting water demand in Napa and Solano Counties, a water conservation plan must address the shortages which could occur by 1985 because of redistribution of current water supplies and future growth in the two-county service area. The following water conservation program identifies elements that would reduce water consumption significantly by 1985. Further water conservation which could be achieved by the year 2000 is also projected.

3.2.3.1.3 This plan describes only major water conservation elements which

*The discussion of this alternative was prepared by DWR's Office of Water Conservation. Some of the measures suggested may be within the capability of DWR, but implementation would be primarily by local agencies.

can be quantified in a reasonably dependable manner based on existing data and research. These elements include (1) installation of water conservation devices to reduce consumption in existing toilets, showers and faucets, (2) modification of current landscape maintenance and future landscape design to reduce exterior urban use, (3) regulation of water pressure, and (4) detection and repair of system leaks. These elements could be employed either individually or in concert in various localities according to water needs, financial constraints, and local conditions. The conservation potential of the relatively high water use commercial and industrial sector is not discussed in this plan. While the conservation potentials within this sector might be significant, more research would be necessary to quantify any possible water savings.

WATER CONSERVATION DEVICE DISTRIBUTION PROGRAMS

3.2.3.1.4 The Department of Water Resources (DWR) has direct experience with several types of water conservation device distribution programs. /22/ Two of these programs would be applicable to communities in Napa and Solano Counties: (1) direct mail distribution of kits and (2) free installation of individual devices. The direct mail alternative is less costly but would result in considerably less water saved. Conversely, the free installation program is more costly but would achieve higher installation rates and use devices save more water.

3.2.3.1.5 Direct Mail Distribution: Under a direct mail program, kits would be purchased from a manufacturer who would mail them directly to households by using bulk rate mailing. Each kit would contain two toilet devices (plastic bags), shower flow restrictors sufficient for one shower, a pair of dye tablets to check for toilet leaks, and an informational brochure which would encourage installation of the devices and would provide information on other ways to save water. The program would be accompanied by a promotional campaign managed by a professional advertising agency and would include paid advertising using newspaper, radio, and possibly television advertisements. The program could also be promoted through the use of low-cost promotional methods such as bill stuffers and press conferences. Cost estimates for such a program are indicated in Table 3-3. Previous programs conducted by DWR have shown that 40 percent of the households install and retain the toilet devices and that 10 percent of the households install and retain the shower devices. /23/

3.2.3.1.6 Estimated 1980 water and energy savings for the direct mail distribution program are included in Table 3-4. Projections for yearly savings in 1985 and 2000 are presented in Table 3-5. A 1½ percent reduction of base 1980 savings by 1985 and a 6 percent reduction by 2000 due to the demolition of older housing units are reflected in these projections. /24/

3.2.3.1.7 Free Installation Program: DWR conducted a program of installing free water-conservation devices in the Community of Oak Park in Ventura County during 1977. /25/ During that program, all households in the community were contacted to see if they would allow free water-conservation devices to be installed in their homes. Of the 753 households in the community, 667 (88.6 percent) allowed devices to be installed. After 22 months a survey was conducted which found that 50.5 percent of the community's toilets still had devices installed and 56.9 percent of the showers still had devices in place. A promotional campaign using no paid media was conducted along with the installation. Although this was appropriate for the small number of homes in the Oak Park program area, a promotional program similar to that discussed under Direct Mail Distribution would be more appropriate in Napa and Solano Counties.

TABLE 3-3 COST ESTIMATE FOR DIRECT MAIL DISTRIBUTION OF WATER CONSERVATION DEVICES

	Napa	Solano	Total
Kits	$31,000	$ 64,000	$ 95,000
Promotion	15,000	35,000	50,000
Management	12,000	28,000	40,000
TOTAL	$58,000	$127,000	$185,000

TABLE 3-4 ESTIMATED 1980 WATER AND ENERGY SAVINGS FOR DIRECT MAIL DISTRIBUTION PROGRAM

Water	Napa	Solano	Total
Toilets (af/yr)	145	320	465
Showers (af/yr)	126	278	404
TOTAL	271	598	869
Energy (in equivalent barrels of oil at a cost of $35 per barrel)			
Oil Equivalent	4,100 bbl	9,000 bbl	13,100 bbl
Value	$143,500	$315,000	$458,500

TABLE 3-5 PROJECTED WATER AND ENERGY SAVINGS FOR DIRECT MAIL DISTRIBUTION PROGRAM

	1985		2000	
	Napa	Solano	Napa	Solano
Water Saved (af/yr)	267	589	255	562
Value (based on current retail price of water)	$65,100	$115,400	$62,200	$110,200
Annual Energy Savings (for hot water distribution)	4,000 bbl	8,000 bbl	3,800 bbl	8,400 bbl
Value ($35/bbl)	$140,000	$280,000	$133,000	$294,400
Total Annual Value Saved	$205,100	$395,400	$195,200	$404,600

Benefit/Cost Ratio

Discount Rate	Napa	Solano	Total
5%	47.27	44.76	45.55
7%	40.80	38.48	39.21
10%	33.59	34.84	34.45

3.2.3.1.8 The Oak Park program was conducted during the 1976-77 drought and even though that community was not directly impacted by the drought, the fact that the drought was a frequent story on local news probably had some effect on public acceptance of the devices. Therefore, other factors being equal, a lower installation rate would be likely for a non-drought year. A reasonably intensive promotional campaign should be able to overcome this problem and increase the installation rates to the levels of the 1977 program.

Therefore, installation rates are assumed to be the same as for the Oak Park program. Although faucet restrictors were not used in the Oak Park program, they are recommended for use in this installation program. It is assumed that they would have a similar installation and retention rate to showers. Their water savings are calculated at 1 percent of interior water use. /26/

3.2.3.1.9 Devices used in an installation program would be more expensive than those used for a mailout program and would include double-edged dams for toilets, shower flow restrictors, and new showerheads where restrictors produced an inadequate shower spray. Faucet flow restrictors would also be installed. The program could be managed by local governments with assistance from DWR. Costs of the program are estimated at $841,000 for Napa County, $1,671,000 for Solano County; for a total of $2,512,000. Estimated water and energy savings for the free installation program are presented in Table 3-6. A 1-1/2 percent reduction of base 1980 savings by 1985 and a 6 percent reduction by 2000 due to demoliltion of older housing units are reflected in these projections. /27/ The program would have a benefit/cost ratio of from 12 to more than 17 to one, depending on the rate assumed for the time value of money (10 percent gives 12, 5 percent gives 17).

LANDSCAPE WATER CONSERVATION

3.2.3.1.10 An effective water conservation plan would reduce exterior urban water use in existing and new landscapes. Water use in existing landscapes would be reduced by increasing the efficiency of irrigation and maintenance practices through the adoption of "water waste" ordinances, possibly supported by an educational program and a restructuring of water rates. Water use in new landscapes would be reduced through institutional measures designed to encourage or require low water-using landscapes. Such landscapes cost no more to install or maintain than other landscapes.

3.2.3.1.11 Existing Landscapes: Water use could be reduced in most landscapes by 20 percent without harm by using more efficient irrigation practices. A 20 percent reduction is a reasonable estimate based on reported water savings of 25 to 90 percent by governmental agencies and various landscaping firms during the drought due to efficient irrigation and maintenance practices. /28,29/ This reduction could be achieved by adoption of a "water waste" ordinance in both counties. A simple, equitable, and effective "water waste" ordinance focusing on large water users such as multiresidential and commercial establishments is in effect in Albuquerque, New Mexico. Cooperation with the ordinance has been so good that no fines or service suspensions have been required. Such an ordinance in Solano and Napa Counties would eliminate excess landscape water, fugitive water, and water waste through an enforcement process focused primarily on large water users. After several warnings, violations such as unrepaired irrigation leaks and gutter flooding would be misdemeanors punishable by fines. If a violation continued and became a hazard to the health and welfare of the community, suspension of service could result.

TABLE 3-6

ESTIMATED WATER AND ENERGY SAVING FOR FREE INSTALLATION PROGRAM
($ values in thousands)

	1980			1985			1990		
	Napa	Solano	Total	Napa	Solano	Total	Napa	Solano	Total
Toilets (AF/Yr)	434	955	1,389						
Showers (AF/Yr)	708	1,557	2,265						
Faucets (AF/Yr)	45	98	143						
TOTAL SAVING	1,187	2,610	3,797	1,169 1/	2,571 1/	3,740 1/	1,116 1/	2,453 1/	3,569 1/
Yearly Value of Water Saved ($)	290	512	802	285	504	789	272	481	753
Yearly Energy Savings:									
Equivalent Barrels of Oil (bbl.)	23,000	50,000	70,000	22,700	49,200	71,900	21,600	47,000	68,600
Value at $35/bbl. ($)	805	1,750	2,555	794	1,722	2,516	756	1,645	2,401
TOTAL ANNUAL SAVING ($)	1,095	2,262	3,357	1,079	2,226	3,305	1,028	2,126	3,154

1/ Total savings determined using 1½% reduction in 1985 and 6% in 2000 as explained in text.

3.2.3.1.12 A "water waste" ordinance would be administered by the appropriate county or city department, such as the water department or environmental health department. Enforcement would be accomplished by existing field staff, such as meter readers. Additional staff may be required to work with large water users (parks, schools, etc.) to assist in designing efficient irrigation systems and schedules. The estimated yearly cost for enforcement in Napa County would be approximately $50,000 for one additional person, and in Solano County approximately $50,000 for one additional person. It is anticipated that the four major cities in the two-county area (Napa, Fairfield, Vacaville, and Vallejo) would each require a half-time staff person at $25,000 per year. The total cost for Napa County, including City of Napa would be $75,000 per year. The total cost for Solano County including the three large cities would be $125,000 per year.

3.2.3.1.13 Landscape water conservation could also be promoted through revision of rate structures. Uniform rates and declining block rates which are currently employed could be replaced with increasing block rates or peak load rates which encourage conservation. In addition, improvement of current landscape irrigation and maintenance practices could be hastened with a program of public information and education describing techniques such as mulching and watering during periods of low evaporation. Based on promotional costs of previous conservation efforts undertaken by DWR, a yearly expenditure of $100,000 is estimated for such a program.

3.2.3.1.14 New Landscapes: Water use could be reduced substantially in new landscaping through adoption of ordinances, general plan modifications, and building code specifications. An ordinance to require low water-using landscapes in all new commercial, industrial and multifamily residential developments could be adopted. Also, model homes in new subdivisions could be required to install low water-using landscapes as demonstrations. To administer and enforce this ordinance, each city and county planning department should have a qualified landscape specialist to review all landscape plans as part of the design review process. Building permits should not be approved until landscape plans are approved. As part of the landscape plan review, the staff landscape specialist would recommend low water-using design ideas, which might include low water-use plants; drip irrigation systems, automatic irrigation systems, permeable paving and on-site catchment basins. The grading plan, and removal or protection of existing vegetation would also be reviewed, with revisions made if necessary. The degree of water-conserving features required in a landscape would be flexible in order to suit the variety of landscape uses anticipated in each project.

3.2.3.1.15 Specific landscaping measures which should be reflected in city and county policy to encourage water conservation would include:

° Landscaping with low water-consuming plants wherever feasible.

° Minimizing use of lawn in commercial, governmental, and industrial facilities and multifamily residential units by limiting it to lawn-dependent uses.

° Use of mulch extensively in all landscape areas. Mulch applied on top of soil will improve the water-holding capacity of the soil by reducing evaporation and soil compaction.

° Preserving and protecting existing trees and shrubs. Established plants are often adapted to low water conditions, and their use saves water needed to establish replacement vegetation.

° Installing efficient irrigation systems which minimize runoff and evaporation and maximize water to the plant roots. Drip irrigation, soil moisture sensors and automatic irrigation systems are a few methods of increasing irrigation efficiency.

- Using pervious paving material whenever feasible to increase penetration of rainfall into the soil, thereby reducing the need to irrigate artificially.

  Grading slopes to maximize penetration of water into the soil to reduce water waste and the need for additional irrigation.

- Investigating the feasibility of utilizing reclaimed waste water, stored rainwater, or household gray water for irrigation.

3.2.3.1.16 Projected 1985 and 2000 exterior water savings in the two-county service area are presented in Table 3-7. A 20 percent reduction in exterior water demand is assumed in new single-family homes in Napa and Solano Counties. Approximately 5 percent of this reduction will be due to installation of low water-using landscapes prompted by the required low water-use landscapes installed in all subdivision model homes. A low figure of 5 percent is estimated because the actual water savings are not available. The remaining 15 percent reduction in water demand from new single-family homes would result from adoption of water waste ordinances as previously described; 15 percent reduction is expected in new single-family landscapes rather than 20 percent estimated for existing landscapes because newer irrigation systems typically apply water more efficiently than older systems, so there is less wasted water from runoff and leaks.

3.2.3.1.17 A 40 percent reduction in exterior water demand is estimated for new multifamily homes and commercial and public developments, with 15 percent of the total reduction resulting from the water waste ordinance. The remaining 25 percent reduction in water demand would result from adoption of the landscape water conservation ordinance. Only a 25 percent reduction is estimated because the actual water savings which will result are not available. Potential water savings from a water-conserving landscape versus a traditional landscape can be as high as 65 percent. /30/

3.2.3.1.18 Implementation of measures to reduce exterior water use could be achieved with existing city and county staff, but some additional staffing would be helpful at the county level and in the larger cities. The yearly cost in Napa County would be $75,000, and the yearly cost in Solano County would be $125,000. The yearly cost for Napa County includes $50,000 for one full-time person in the county and one part-time person at $25,000 in the City of Napa. The yearly cost in Solano County includes $50,000 for one full-time person in the County, and three part-time people at $25,000 each in Vallejo, Vacaville and Fairfield.

LEAK DETECTION AND REPAIR

3.2.3.1.19 Increasing attention has been paid in recent years to the water-saving potential of leak detection and repair. As the price and scarcity of water increase, and as detection technology advances, more water agencies are finding that leak detection is economical and feasible. On a nationwide average, 12 percent of distributed water is lost through leaks, and 9 percent could be saved. Because water systems in California tend to be newer than average and better-maintained, 4 percent repairable leakage will be used for estimation in this report. /31/ At this rate, yearly loss through repairable leaks is estimated to be 3,300 acre-feet in the two-county service areas. It should be recognized that some communities with very new water systems or systems in good repair will have very little capacity for conservation through leak detection. On the other hand, some communities will very likely exceed a 4 percent repairable leakage. A leak-detection and repair program is being implemented by the East Bay Municipal Utility District (EBMUD) in Contra Costa and Alameda Counties. Leak detection in

TABLE 3-7

POTENTIAL EXTERIOR MUNICIPAL WATER CONSERVATION
IN SOLANO AND NAPA COUNTIES

	Napa	Solano	Total
Reduction in Existing Landscapes (20%/yr)(af/yr)	1,674	3,490	5,164
Yearly Savings 1980	$408,500	$684,000	$1,092,500
Increase in Demand by 1985 (af/yr)	686	1,441	2,127
Reduction in Water Use, New Single-Family Home Landscapes, 1985 (20%/yr)(af/yr)	62	130	192
Reduction in Water Use, New Multi-Family Home, Commercial, Government Landscapes	151	317	468
Total Water Reduction 1985 (af/yr)	1,887	3,937	5,824
Yearly Savings 1985	$460,400	$771,600	$1,232,000

Increase in Demand, 1980 to 2000 (af/yr)	2,706	4,850	7,556
Reduction in Water Use, New Single-Family Home Landscapes, 2000 (20%/yr)(af/yr)	244	436	680
Reduction in Water Use, New Multi-Family Home, Commercial, Government Landscapes, 2000 (40%/yr)(af/yr)	595	1,067	1,662
Total Yearly Reduction 2000	2,513	4,993	7,506
Yearly Savings 2000	$613,200	$978,600	$1,591,800

Benefit/Cost Ratio

Discount Rate	Napa	Solano	Total
5%	2.738	2.517	2.596
7%	2.702	2.487	2.564
10%	2.652	2.245	2.391

the EBMUD program is carried out by two crews, each consisting of two persons that survey the water system with electronic leak-detection equipment. These two crews can survey the entire EBMUD system in 4 years. /32,33/

Estimated costs and benefits for programs in Napa and Solano Counties, presented in Table 3-8, are based on one similar crew working in each county, surveying all systems within 5 years.

TABLE 3-8

POTENTIAL RESULTS OF LEAK DETECTION AND REPAIR IN SOLANO AND NAPA COUNTIES

	Napa	Solano	Total
Water Saved (ac-ft/yr)			
1985	928	2,368	3,296
2000	1,228	3,200	4,428
Total Yearly Cost			
1985	$12,600	$32,100	$44,700
2000	$16,700	$43,000	$59,700
Dollars Saved			
1985	$226,400	$464,100	$690,500
2000	$299,600	$627,200	$926,800
Benefit/Cost Ratio			
Discount Rate			
5%	14.60	11.78	12.57
7%	14.09	11.37	12.13
10%	13.31	10.74	11.46

PRESSURE REGULATION

3.2.3.1.20 The maximum pressures in larger municipal water systems of Napa and Solano Counties range from 65 to 135 psi. /34/ This is generally higher pressure than is required for water delivery. The California Public Utilities Commission, for example, allows normal water pressure of 40 psi and pressure at times of maximum demand of 30 psi.

Installation of pressure regulators on interior residential systems to reduce the pressure to 50 psi would reduce interior consumption by an average of 5 percent. /35/ By 1985, a retrofit program could be saving 574 acre-feet per year in the two-county area. Year 2000 savings could be 663 acre-feet per year. Installed pressure regulator costs of $50 for retrofit and $30 for new construction have been used to develop Table 3-9.

TABLE 3-9

POTENTIAL RESULTS OF WATER PRESSURE REGULATION
IN SOLANO AND NAPA COUNTIES

	Napa	Solano	Total
Water Saved (af/yr)			
1980	177	369	546
1985	191	377	568
2000	234	394	628
Total Yearly Cost			
1980	$1,840,000	$3,785,000	$5,625,000
1985	33,450	95,100	128,550
2000	33,450	95,100	128,550
Dollars Saved (Water)			
1980	43,200	72,300	115,500
1985	46,600	73,900	120,500
2000	57,100	77,200	134,300
Dollars Saved (Energy)			
1980	179,500	373,300	552,800
1985	193,700	382,400	576,100
2000	237,300	399,600	6[illegible]6,900
Total Dollars Saved (Water and Energy)			
1980	222,700	445,600	668,300
1985	240,300	456,300	696,600
2000	294,400	476,800	771,200
Benefit/Cost Ratio			
5%	1.505	1.242	1.324
7%	1.321	1.107	1.174
10%	1.105	.944	.995

ADDITIONAL WATER CONSERVATION MEASURES

3.2.3.1.21 In addition to the water-conservation measures discussed in preceding sections, there are a number of other measures which could bring about water savings. These measures have not been examined in detail because costs and water savings could not be quantified without additional specific research in the service area. Some of these are:

° Requiring the insulation of hot water supply lines.

° Prohibiting the sale of nonwater-saving clothes washers and dishwashers.

° Developing a water-conservation education program for classroom use.

° Prohibiting service of water to restaurant customers except on request.

° Requiring recycling systems for decorative fountains.

° Prohibiting water softeners where they are not needed.

° Requiring central recharging of water softeners.

AGRICULTURAL WATER CONSERVATION

3.2.3.1.22 Agricultural water conservation encompasses saving water on an individual farm through increasing "basin efficiency". In both instances, efficiency is measured as the proportion of the prime water supply that is used to fulfill the primary purpose of irrigation, which is to supply the evapotranspiration (ET) needs of the crops. Only three things can happen to applied irrigation water: (1) it can be consumed in ET; (2) it can run off the land to which it is applied, becoming drainage water; and (3) it can percolate into the soil below the root zone. On-farm efficiency is increased by reducing the proportion of the applied water that becomes drainage water or deep percolates. Basin efficiency is increased when drainage water is captured and reused and when water that deep percolates recharges aquifers that are pumped for irrigation water supply.

3.2.3.1.23 The methods of increasing on-farm irrigation efficiency are currently an active field for research. Among these methods, some of which are already in common use, are the following:

° drip irrigation,

° using shorter furrows,

° dead-level basin irrigation,

° furrow irrigation by surging head,

° sprinkler irrigation (especially at night),

° tailwater recycling,

° improved *irrigation scheduling* (scheduling irrigation in closer correlation with ET requirements as dictated by climatic conditions),

° weed control, and

° lining or enclosing on-farm ditches and canals.

3.2.3.1.24 Although irrigation water is applied mainly to meet ET requirements, some water may also be required to maintain salt balance in the root zone. The additional water required for this purpose is called the leaching requirement, and it varies with annual precipitation, soil characteristics, salt concentration in the irrigation water, and other factors. Because of higher-quality irrigation water and more rainfall, leaching requirements in Solano County are low compared to those of other areas of California such as the San Joaquin Valley and the Coachella Valley.

3.2.3.1.25 Going beyond irrigation efficiency in the usual sense, water savings can be achieved by reducing ET demands. ET is the sum of water consumed by evaporation from the soil surface and transpiration through the leaves. Since evaporation from the soil surface does not contribute to growth of the plants, this component of ET represents an opportunity for water saving. The opportunity can be best exploited in young orchards and vineyards when the plants are small and the leaves shade only a small proportion of the soil surface. Drip irrigation can be used in this situation to apply water only to the immediate surroundings of each individual plant. Researchers have also experimented with reducing the transpiration component of ET. This has been accomplished by applying certain chemicals to the leaves, but the technique has not yet been suggested for general agricultural use.

3.2.3.1.26 There are several other means of reducing ET that are currently in common use. Farmers reduce ET when they stop irrigating near the end of the growing season, as is done with grapes and sugarbeets to attain a higher sugar content. They also reduce ET when they apply a chemical to force ripening all at once to accommodate machine harvesting. The two foregoing reductions in ET, however, are considered in the determination of normal ET rates. Changing the cropping pattern is another way to reduce overall ET, since different crops have different ET requirements. Farmers' decisions on which crops to grow are influenced by economics, soil-crop suitability, climate, and other factors. Experience has shown that farmers will switch to crops with lower ET requirements when a water shortage is anticipated.

3.2.3.1.27 A true measure of agricultural water conservation must consider basin efficiency as well as on-farm efficiency. Frequently, excess water applied to one farm runs off and becomes water supply to another farm downslope. Thus, basin efficiency may be quite high even though the on-farm efficiency of any individual farm in the basin may be well below the maximum achievable. According to a recent DWR study, the farms that use surface water from the Solano Project produce about 37,000 acre-feet per year of reusable agricultural drainage water. /36/ The same DWR study, relying in part on data supplied by the Solano Irrigation District (SID), indicates that about twothirds of this drainage water is already being reused, mainly in the Maine Prairie Water District, which lies downslope from SID. In 1980 only about 4,000 acre-feet of the total 37,000 acre-feet of drainage water in both Districts was not reused during the irrigation season. /37/ This reuse figure represents the maximum potential water saving or increased water supply realizable by increasing irrigation efficiency in the Solano Project service area. Since 1980 was regarded as an above-average rainfall year, the reuse figure for normal years would be presumed to be lower. Since it is projected that an increase of 26,700 acre-feet in applied water demand between 1980 and 2000 will occur (assuming no increase in the prime water supply), the 3,000 to 4,000 acre-foot potential will be required to meet agricultural demands. This potential might be realized by increased on-farm efficiency that would conserve and extend the prime supply or by increased basin efficiency through increased capture and reuse of drainage water. In either case, the water could not be considered to be available in any form for transfer or exchange to supplement urban water supplies.

3.2.3.1.28 Although the Solano Project agricultural service area provides the physical means (Putah South Canal) to transport agricultural water savings achieved within its boundaries into water supplies for the cities served by the same project, any water savings achieved in the other scattered agricultural areas would be difficult and costly to collect and transport for municipal use. In addition, transport of any

"surplus" agricultural water through the Putah South Canal could also be prohibited because of existing downstream water quality commitments. Consequently, agricultural water conservation would not appear to be a promising method of developing new urban water supplies in the proposed North Bay Aqueduct service area.

CONSERVATION MEASURES CURRENTLY IN EFFECT

3.2.3.1.29 Napa and Solano Counties were among the most severely affected in the State during the recent drought. Most, if not all, of the communities in these counties initiated some sort of conservation program at that time. Although water use is once again increasing, there is certainly some residual effect on local water consumption. Preliminary studies indicate that adjusted per capita water use in various communities in these two counties has been reduced 2 to 32 percent from 1975 levels. Based on this limited investigation, an areawide reduction of up to 14 percent may still be taking place. Greater emphasis would have to be placed on maintaining existing conservation levels as well as encouraging new conservation efforts.

SUMMARY

3.2.3.1.30 This discussion of water conservation includes many specific suggestions. Not all of these techniques would be practical or useful in every locality. Some of these procedures have already been put into effect in some areas, largely in response to the recent drought. However, most of the elements quantified in this plan would be useful in both counties, and the ideas which are not quantified would increase the overall attractiveness of water conservation.

3.2.3.1.31 The domestic water conservation figures in this plan reflect a conservation program which would be ambitious but would not raise insurmountable social, economic, or institutional problems. Most elements of the plan could be applied in most communities, and other conservation techniques could undoubtedly be applied in each community as well. Therefore, these figures should be viewed as reasonable, achievable conservation levels. Table 3-10 summarizes the results of an urban water conservation program. Use of the more expensive but more effective "free installation" device distribution program rather than the "direct mail" method has been assumed for these totals. The water conservation program could significantly reduce water demand in Solano and Napa Counties. This reduction is particularly advantageous because it would be accompanied by a net dollar savings rather than an expenditure, and because it would save energy too. The benefit/cost ratio for the entire program would be 4.634 at a 5 percent discount rate, 4.281 at 7 percent, and 3.777 at 10 percent.

3.2.3.2 Waste Water Reclamation (2)*

3.2.3.2.1 Waste water, a water supply source that will become more important in California as demands on limited fresh-water supplies increase, already contributes to meeting some water demands in central Solano County. Some potential exists to expand the role of waste water reclamation in the area in response to increasing water demands. While such potential is promising, it must be considered in light of a variety of economic, environmental, and institutional constraints.

3.2.3.2.2 Waste water reclamation means making beneficial use of water that otherwise would be discharged as waste. Improved treatment has made reuse (i.e., reclamation) of sewage treatment plant effluent more attractive in recent years. Treated effluent may be used in agricultural and landscape irrigation; limited industrial applications, such as for cooling water; and wildlife habitat

*The discussion of this alternative was prepared by DWR's Central District staff. Implementation would be by local agencies and/or DWR.

TABLE 3-10

SUMMARY OF WATER CONSERVATION PLAN, YEAR 2000
(Water Savings and Demand in Ac-Ft/Yr)

	Solano County	Napa County	Both Counties
Base Demand 1/ (at historical use rate)	87,800	34,000	121,800
Water Savings from Mandated Measures 2/	3,300	1,100	4,400
Water Savings from Recommended Measures:			
Free Device Installation Program (Table 3-8)	2,453	1,116	3,569
Exterior (Table 3-9)	4,993	2,513	7,506
Leak Detection and Repair (Table 3-10)	3,200	1,228	4,428
Pressure Regulation (Table 3-11)	394	234	628
TOTAL SAVINGS	14,340	6,191	20,531
Net Demand with Conservation (Base Minus Total Savings)	73,460	27,809	101,269
Total Yearly Cost 3/ ($)			688,250
Total Dollars Saved 3/ ($)			6,443,800
Net Yearly Savings 3/ ($)			5,755,550

1/ Department of Water Resources, "Water Action Plan for the Southwest Sacramento Valley Service Area", 1980.

2/ Health and Safety Code, Section 17921.3, January 1, 1978, requires low-flush toilets in new buildings. California Administrative Code, Title 20, Chapter 2, sub. 4, art. 4, December 22, 1978, requires water-conserving faucets and shower heads.

3/ Recommended measures only.

enhancement; but not for drinking water. /38/ The North Bay Aqueduct would be constructed to augment municipal water supplies in its service area. Thus, waste water reclamation is an alternative to the extent that it could: (1) possibly replace fresh water in uses where treated waste water is an allowable substitute, or (2) provide new sources of fresh water through exchange arrangements.

3.2.3.2.3 The local water supply projects program of the State Water Project (SWP) applies to waste water reclamation projects, as well as to dams, reservoirs, and ground water storage. The water can be delivered directly to a project contractor or indirectly through exchange agreements. The program can provide technical, economic, and financial feasibility studies, plus SWP financing through Central Valley Project revenue bonds. The projects can be operated by the SWP, or jointly by the SWP and a local agency.

3.2.3.2.4 Under an existing contract, the Solano Irrigation District (SID) may receive up to 6,000 acre-feet of treated waste water annually from the Fairfield-Suisun Sewer District plant about 3 miles southwest of central Fairfield. In exchange, SID supplies an equal amount of potable Solano Project water to the City of Fairfield, thus augmenting the City's water supply. In this arrangement, the waste water is primarily used to irrigate a turf nursery near the treatment plant. The turf nursery uses about 3,000 acre-feet per year. Waste water is also used to seasonally flood duck club hunting areas east of the treatment facility. Currently, the capacity of the treatment plant is being increased and the level of treatment is being improved. When the improvements are completed in 1981, the plant effluent will meet public health requirements for spray irrigating food crops, and SID may take more waste water to irrigate orchards west and southwest of Fairfield. SID expects to begin taking the full contract amount by 1981, although the District Manager is concerned that agricultural demand in the area may not support full utilization of the water supply in wetter years. /39/

3.2.3.2.5 Most opportunities to employ waste water reclamation to increase municipal water supplies in the North Bay Aqueduct service area lie within the areas of Solano County (Fairfield-Vacaville area) where exchange with SID for Solano Project water from Lake Berryessa are possible. A current estimate of the amount of waste water that could be produced in this area annually by 2000 is 23,000 to 30,000 acre-feet. /40/ Although use of this waste water to indirectly augment municipal and industrial water supplies through exchange is theoretically possible, a variety of problems may limit its full utilization, including:

- Environmental and Quality Considerations. Treated waste water often contains salts and heavy metals in concentrations high enough to cause concern regarding long-term effects on agricultural productivity, since these constituents may accumulate in the soil. Degradation of the underlying ground water is another concern. These concerns notwithstanding, use of treated waste water for irrigation is widespread in California, and few problems have been reported.

- Institutional Constraints. SID has officially expressed pessimism concerning the possibility of any future exchange agreements. /41/ The SID board has not ruled out new exchange agreements, but it no longer entertains proposals for exchange on a one-for-one basis. Board members are concerned that salt buildup from waste water irrigation could eventually damage productivity or cost District landowners money for remedial measures such as tile drainage. Also, SID has found its existing exchange contract troublesome due to the requirements of regulatory agencies. /42/

° Seasonal Availability. Waste water is generated year-round, while most irrigation water is needed in Solano County during a 5-month irrigation season from May through September. Thus, only a fraction of total waste water supplies can be made available to irrigators unless large reservoirs are constructed. Vacaville considered building a reservoir but could not find a suitable site.

° Cost. To increase water exchange between Fairfield-Suisun Sewer District and SID in excess of the present contract, expensive new conveyance facilities would be required to transport treated waste water to parts of SID that are much farther from the treatment plant than existing conveyance facilities can reach.

3.2.3.2.6 Faced with an increasing volume of treated waste water and a Regional Water Quality Control Board prohibition against discharging to the Suisun Marsh during the dry months of the year, the Fairfield-Suisun Sewer District has proposed building an 11.7-mile pipeline to deliver some of its treated waste water to SID's Dally Service Area. This would allow exchange of waste water not committed by the existing contract.

3.2.3.2.7 The Dally Service Area is east of Fairfield and north of Travis AFB. The Regional Board estimates that Fairfield-Suisun could deliver 4,000 acre-feet there in 2000 during the irrigation season, and twice that amount in 2020.

3.2.3.2.8 A 1980 engineering feasibility study concluded that the Dally pipeline project was the most economic remaining option for agricultural reuse of Fairfield-Suisun treated waste water. /43/ The cost of the pipeline system was estimated at $18 million. /44/ The sewer district applied for Clean Water Grant Program Funding for the project, but the application was denied.

3.2.3.2.9 A current proposal for implementing the Dally pipeline project would involve the SWP local water supply projects program. SID would give Fairfield 1.5 to 2.0 gallons of fresh water for every gallon of treated waste water received at Dally, and Fairfield would release back to the SWP an amount of its North Bay Aqueduct entitlement equal to the amount of new fresh water it obtains from SID. For providing partial financing, SWP would obtain an increase in uncommitted yield that would count toward realizing its authorized yield of 4.23 million acre-feet a year.

3.2.3.2.10 The Regional Water Quality Control Board is advocating the Dally pipeline proposal, but this is only one of several alternatives being considered as solutions to Fairfield-Suisun's waste water disposal problem.

3.2.3.2.11 Prior to consideration of an exchange contract between SID and the City of Vacaville, Vacaville would have to upgrade its treatment facilities to produce reusable effluent that would meet current public health standards. The City considers this too expensive to undertake on its own, and grant funds are not available for this purpose. /45/ Such an upgrading would at least raise the possibility that supplemental municipal and industrial water supply for Vacaville could be obtained in an exchange with SID.

3.2.3.2.12 A study published by DWR in 1980 recognizes that urban reclamation could be increased in Solano County by the year 2000. /46/ However, the study assumes that no additional waste water reuse will occur by the year 2000, primarily due to the problems discussed above. If an increase should occur, the study assumes the full amount will be used to meet agricultural demands expected to develop during the next 20 years. Since these will be new demands, the study does not foresee transference

of any of the existing agricultural supplies to municipal and industrial use.

3.2.3.2.13 Some potential exists in the North Bay Aqueduct service area for nonagricultural uses of waste water, but these uses represent only a small fraction of total municipal and industrial demand. Since no industrial plants exist within the service area that can use large amounts of water of below-drinking standard, direct nonagricultural uses of waste water in the area would be limited to landscape irrigation in turf areas such as parks and cemeteries. Separate plumbing would be required to get the effluent from the treatment plant to the place of use. The City of Fairfield proposes to irrigate all its major parks plus a cemetery and a high school grounds with treated waste water if the Dally pipeline project is implemented. In addition, future industrial parks located in Fairfield are required to have dual water systems to accommodate reclaimed waste water.

3.2.4 Mixed Water Supply Alternative (1)

3.2.4.1 A balance between water demand and supply might be achieved by implementing not just one, but rather a combination of the alternatives heretofore discussed. Such a combination might effect a decrease in SWP costs with an increase in long-term reliability.

3.2.4.2 As indicated in Table 3-2, the combined excess of demand over supply (supplemental water requirement) in Solano and Napa Counties is projected to be around 31,000 acre-feet in the year 2000 -- 21,000 acre-feet in Solano, 10,000 in Napa. This projection assumes adoption of legally mandated water conservation plus some additional measures described in Appendix G.

3.2.4.3 As Table 3-12 indicates, a more active water conservation program can save about 20,500 acre-feet of water in 2000 (compared to historical "base" rates). This would reduce the supplemental water requirement to about 27,000 acre-feet in 2000 -- 17,500 in Solano, 9,500 in Napa -- or about 4,000 acre-feet less than the amount indicated in Table 3-2.

3.2.4.4 It should be pointed out that, in assessing total water supply potential, there is interdependence among conservation, waste water reclamation, and ground water development. Reduced domestic and agricultural use of water through conservation would also reduce both waste water production and ground water recharge.

3.2.4.5 Too little information is available to draw reliable conclusions about how much additional M&I supply could be obtained from ground water. Even though the most recent estimate places ground water supply at about 16,000 acre-feet, various physical (e.g., collection and distribution) and institutional constraints will prevent most of this supply from being used in municipal and industrial applications. The conjunctive use concept, which has the theoretical potential to stretch existing surface supplies, also requires further study to develop a realistic management plan.

3.2.4.6 The West Sacramento Valley Canal could provide a large new water supply for both agriculture and M&I use, but construction is unlikely before the year 2000.

3.2.4.7 Reanalysis of the Solano Project supply could yield some additional water for M&I use or agriculture.

3.2.4.8 Desalination of Suisun Slough water would be expensive and energy-intensive, and the technology must be considered somewhat uncertain. However, the basic physical requirements for large-scale desalting might be met at Suisun Slough and perhaps other places

in the region, provided sufficient electrical power is available.

3.2.4.9 Waste water reclamation beyond that already taking place or contracted for is also somewhat uncertain, but a current reclamation proposal has the potential to produce 2,000 to 3,000 acre-feet of fresh water for M&I use in Solano County annually by the year 2000. This could increase the yield of the State Water Project.

3.2.4.10 The North Bay Aqueduct is the most certain solution to the water supply problem. It could provide (with the associated contract with the City of Vellejo) up to 67,000 acre-feet of M&I water annually if built to full size. With a full-sized aqueduct, local entities would lose some of their incentive to conserve water and develop local water projects. Building a smaller aqueduct would maintain the incentive to conserve and utilize local resources such as waste water. However, aqueduct construction costs are not directly proportional to size -- reducing aqueduct capacity by half, for example, would cut costs less than 30 percent. /47/

3.3 NO PROJECT ALTERNATIVE (2)

3.3.1 This alternative assumes that the proposed North Bay Aqueduct project would not be constructed. The existing Napa County segment of the aqueduct, constructed in 1967 and now carrying 7,500 acre-feet/year of federal Solano Project (Lake Berryessa) water to Napa County, would be assumed to continue its present operation at least until 1984. Also assumed is a continuation of the status quo in the areas of water conservation and waste water reclamation; that is, water conservation resulting from new construction would be acehived, the current exchange contracts of the Solano Irrigation District would be implemented, and other current waste water reuse projects would continue. Finally, it is assumed in this alternative that no new sources of water would be available.

The effects of the No Project Alternative are summarized below:

° In the absence of implementation of other water supply alternatives, a continuation of the present type and rate of growth in Solano and Napa County would eventually cause various areas, especially Fairfield, Vacaville, and Napa Valley to begin running short of M&I water supplies prior to 1990. The risk of serious water shortages during drought years would also increase, although shortages for urban uses might be alleviated by transferring water out of agricultural use.

° The adverse environmental effects associated with construction of the North Bay Aqueduct through Solano County would be avoided.

° Impending shortages of water supply would probably force actions in the early-to-mid 1980s to increase or extend water supplies, such as:

a) Increased ground water pumping, leading to possible overdrafting of ground water aquifers, particularly in the Suisun-Fairfield Valley, and the problems associated with overdrafting (e.g., land subsidence, salt water intrusion).

b) Increases in land use densities as a requirement for enabling development, or a reduction in the rate of growth of the present detached, single-family residential development.

c) Vigorous water conservation programs, voluntary and perhaps mandatory. Extensive water conservation would have positive effects in the areas of reduced energy consumption and attendant energy-related pollution emissions.

d) Increased efforts to reclaim waste water and pressures to arrange exchanges for additional Solano Project water.

e) Increasing pressure to implement a Solano Project Reanalysis, consequently elevating the probability of water deficiencies in dry periods.

f) Increased efforts to secure water supplies from other alternative new water supply sources (e.g., West Sacramento Valley Canal).

3.4 SELECTION OF PREFERRED ALTERNATIVE

3.4.1 The mixed water supply concept, combining water conservation and reclamation with the North Bay Aqueduct and any other supplemental water sources that may become feasible, is selected as the preferred alternative. Conservation and reclamation are selected because they make efficient use of water and energy resources, saving money in the process. The North Bay Aqueduct is selected because it can assure enough water to meet future demand.

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* The "preferred alternative" is the alternative which the applicant (DWR) believes is most desirable based on the environmental analysis presented in this report. For regulatory permit actions such as the subject North Bay Aqueduct, Phase II, project, the Corps takes an impartial position about whether to issue or deny the permit until the public interest review is complete. At no time is the Corps a proponent of any permit action. It simply determines whether or not projects proposed by applicants are in the public interest and under what circumstances such proposals, if modified, would be in the public interest (33 CFR 230). Therefore, the preferred alternative discussed in this report is not designated as such by the Corps of Engineers. If this report was a Corps of Engineers document only, and not a joint Federal/State report, the preferred alternative would not have been included.

REFERENCES CITED:

/1/ U. S. Bureau of Reclamation (Water and Power Resources Service). January 1979. Four-Counties Study, Water Management Opportunities for Lake, Napa, Solano, and Yolo Counties, Status Report.

/2/ Department of Water Resources. July 1978a. Water Action Plan for the Southwest Sacramento Valley Service Area, Preliminary Progress Report.

/3/ Department of Water Resources. July 1978b. Delta Water Facilities - Program for Delta Protection and Water Transfer, Water Conservation, Water Recycling, Surface and Ground Water Storage. Bulletin 76.

/4/ Ibid.

/5/ Department of Water Resources. In progress 1980. Water Action Plan for the Southwest Sacramento Valley Service Area.

/6/ Water and Power Resources Service. 1980. Solano County Water Project: A Report on the Feasibility of Water Supply Development, unpublished draft.

/7/ U. S. Bureau of Reclamation. September 1979. Op cit.

/8/ Ibid.

/9/ Ibid.

/10/ Ibid.

/11/ Department of Water Resources. In progress, 1980. Op cit.

/12/ U. S. Bureau of Reclamation. January 1979. Op cit.

/13/ Department of Water Resources. In progress, 1980. Op cit.

/14/ Letter from Plitt, Charles. Solano County Public Works Department to George Deatherage of Department of Water Resources. August 5, 1980.

/15/ U. S. Bureau of Reclamation. September 1979. Op cit.

/16/ Letter from Charles Plitt. August 5, 1980. Op cit.

/17/ Department of Water Resources. 1980. Request for Proposal for Design of a Desalting Demonstration Module. San Joaquin District.

/18/ Personal communication. Smith, Brian E. DWR, San Joaquin District. April 1981.

/19/ Water and Power Resources Service. January 1979. Op cit.

/20/ Ibid.

/21/ Ibid.

/22/ California Department of Water Resources. October 1978. Bulletin 191, a Pilot Water Conservation Program, including Appendices A through H.

/23/ Copley International Corporation. October 1979. A follow-up survey of of Households Which Participated in the San Diego Pilot Water Conservation Program.

/24/ Assumed demolition rate was derived from estimates by Southern California Association of Governments (SCAG).

/25/ Department of Water Resources. October 1978. Bulletin 191, A Pilot Water Conservation Program, Appendix F.

/26/ California Department of Water Resources. May 1976. Bulletin 198, Water Conservation in California.

/27/ Assumed demolition rate was derived from estimates by SCAG.

/28/ California Department of Water Resources. October 1978. op cit.

/29/ Public Works Magazine. June 1976.

/30/ Personal communication. Marsh, Joseph, General Manager. Green Valley Landscaping, Inc. October 1979.

/31/ Journal of the American Water Works Association. February 1979.

/32/ California Department of Water Resources. October 1978. Op cit.

/33/ Data gathered by the Office of Water Conservation (DWR) via telephone survey, July 1980.

/34/ Ibid.

/35/ Personal communication, Watts Regulatory Company, Lawrence, Massachusetts.

/36/ California Department of Water Resources. December 1978. ate Agency Efforts in Water Conservation, Memorandum Report.

/37/ Personal communication. Bledsoe, Brice. Solano Irrigat[illegible] trict. October 1980.

/38/ California Administrative Code, Title 22, Division 4. 1978.

/39/ Personal communication. Bledsoe, Brice. Solano Irrigation District. July 15, 1980.

/40/ U. S. Bureau of Reclamation (Water and Power Resources Service). September 1979. Op cit.

/41/ Letter from Solano Irrigation District to David Balmer, Administrator for the County of Solano. January 31, 1980.

/42/ Personal communication. Bledsoe, Brice. Solano Irrigation District. July 15, 1980.

/43/ Personal communication. Fisher, Lee. James M. Montgomery Consulting Engineers, Inc. July 15, 1980.

/44/ Fairfield-Suisun Sewer District. April 1980. Economic and Financial Analyses for Waste Water Reclamation, a report prepared by James M. Montgomery, Consulting Engineers, Inc.

/45/ Personal communication. Munoz, J., Public Works Director. City of Vacaville. July 11, 1980.

/46/ Department of Water Resources. 1980. Water Action Plan for the Southwest Sacramento Valley Service Area. Unpublished draft.

/47/ Personal communication. Porterfield, Rennie. Department of Water Resources (Central District). August 1980.

4.0 DESCRIPTION OF THE PROPOSED ACTION

4.1 GENERAL DESCRIPTION

4.1.1 The proposed Phase II facilities of the North Bay Aqueduct would divert up to 61,400 acre-feet annually from the Delta to Napa and Solano County through an open canal and/or a buried pipeline. The Phase II facilities, constructed entirely within Solano County, would connect directly to the existing Phase I facilities of the North Bay Aqueduct now serving Napa County with an interim water supply from Lake Berryessa (via the Solano Project)(Figure 4-1). This interim arrangement, which now supplies 7,540 acre-feet annually to Napa County, could be discontinued in 1984. The City of Vallejo would receive an additional entitlement of up to 5,600 acre-feet of Delta water annually through its existing Cache Slough intake and transport system. The proposed capacity of the Phase II facilities would permit a maximum flow of 115 cubic feet per second (cfs) during peak water demand periods. The existing Vallejo pumping and transport facilities are capable of a maximum flow of approximately 32 cfs. The proposed water delivery schedules for the primary contracting agencies, the Napa and Solano County Flood Control and Water Conservation Districts, are presented in Table 4-1.

4.1.2 Seven basic alternative alignments (routes) for Phase II of the North Bay Aqueduct have been selected for detailed analysis (see Figure 4-1). Six of these alternative alignments (Routes 2 through 7) would have the option of terminating at either a North or South Cordelia Forebay. Proposed turnout locations for delivery of North Bay Aqueduct water to Vacaville, Fairfield, and Suisun City have also been identified. The general criteria for selection of the alternative alignments included provisions for different intake locations, construction and operation costs, avoidance of the Jepson Prairie, avoidance of Suisun Marsh, and minimizing disruption of the urban areas. General construction statistics associated with each alignment are presented in Table 4-2.

4.2 AQUEDUCT ALIGNMENT ALTERNATIVES

4.2.1 The alternative alignments would divert Delta water from either Cache Slough (Routes 1 and 3), Calhoun Cut (Routes 2 and 2A), or Lindsey Slough (Routes 4, 5, 6, and 7). Fish screening facilities would be provided for all diversion pumping plant intakes. Alternative alignments 2 and 6 propose the use of an open concrete-lined canal for water transport from the intake pumping plant westward to an intermediate pumping station south of Travis Air Force Base. From this Travis pumping station water would be transported to a terminal reservoir (Cordelia Forebay) west of Fairfield via a buried concrete pipe. All other alternative alignments (1, 2A, 3, 4, 5, and 7) would consist of a buried pipe for the entire length of the aqueduct. As a result, only two pumping plants (one at the intake and one at the terminus) would be required for each of these alternatives. Figures illustrating the typical pipeline cross-sections during construction (Figure 1) and after construction (Figure 2), a typical open canal cross-section (Figure 3), and a plan view of a typical pumping plant and fish screening facility (Figure 4) are presented in Appendix B.

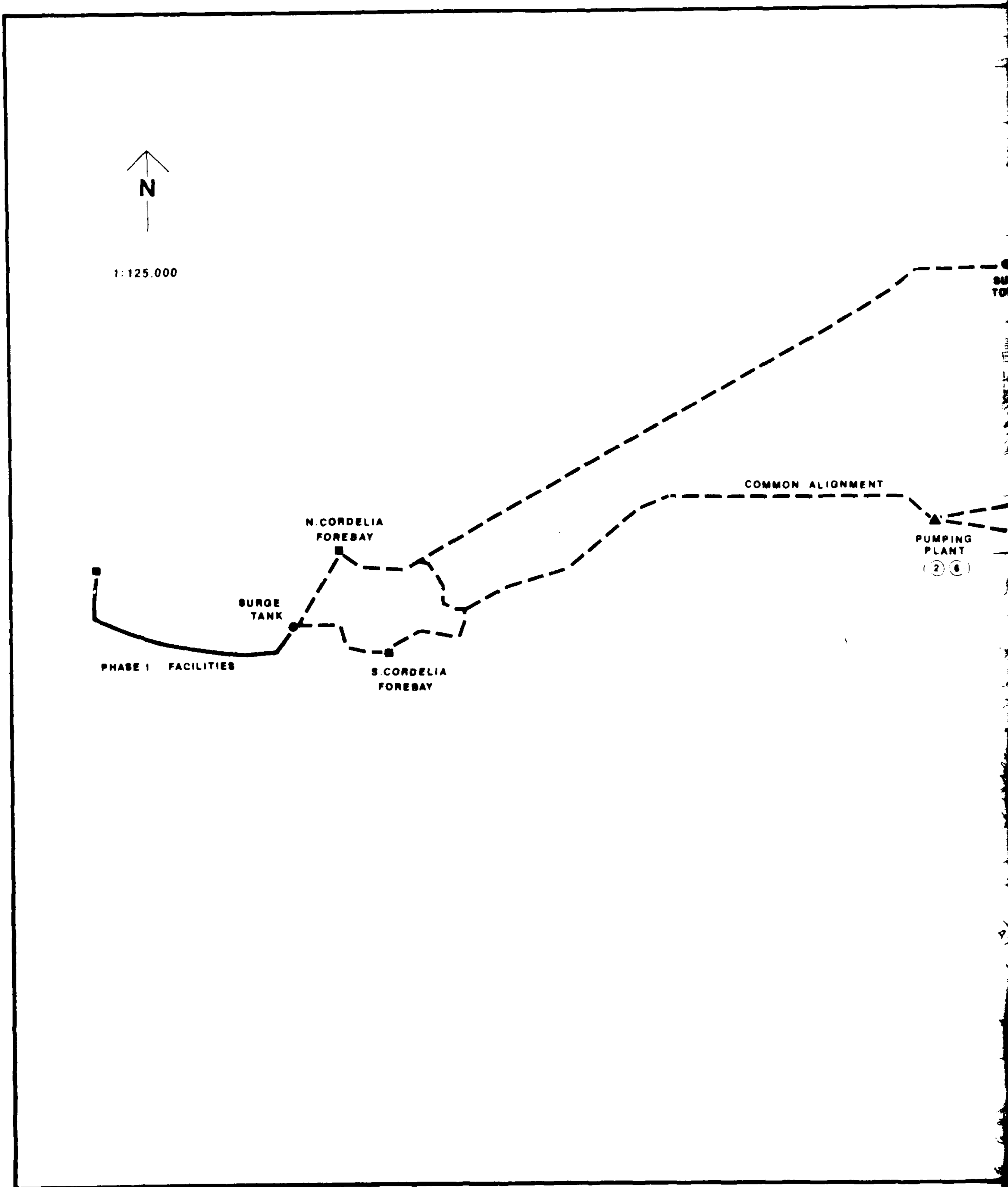
4.2.2 Right of way requirements for the alternative alignments would generally include a 40-foot wide permanent easement

TABLE 4-1

NORTH BAY AQUEDUCT WATER DELIVERY SCHEDULE
(Per Contracts and Contractors' Requests)

	Napa County Flood Control and Water Conservation District	Solano County* Flood Control and Water Conservation District	Total
Annual Entitlement (ac-ft)			
1980	0	500	500
1990	25,000	42,000*	67,000
2000	25,000	42,000*	67,000
2020	25,000	42,000*	67,000
Estimated Requirement (ac-ft)			
1980	0	0	0
1990	10,000	36,400	46,400
2000	16,500	36,400	52,900
2020	20,500	36,400	56,900
Peak Diversion Rate (cfs)	46	68	115
Average Annual Diversion Rate (cfs)	28	51	79

*Includes 5,600 acre-feet to the City of Vallejo that would not be delivered through the North Bay Aqueduct.



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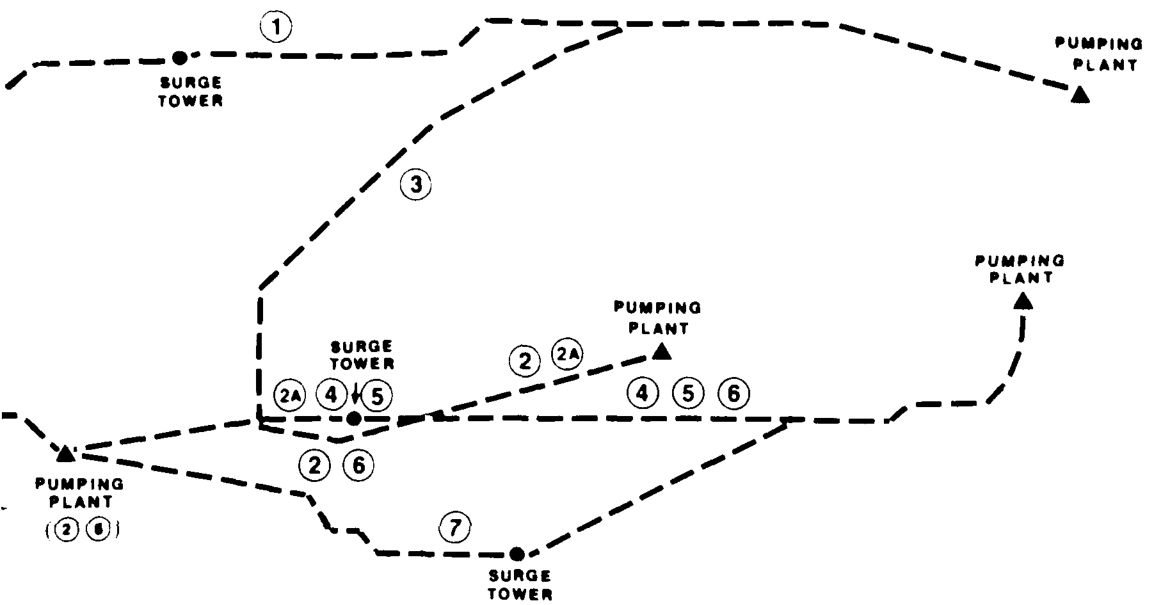


ALTERNATIVE ALIGNMENTS:
NORTH BAY AQUEDUCT
PHASE II FACILITIES

DEPARTMENT OF WATER RESOURCES

FIG. 4-1

TABLE 4-2

CONSTRUCTION STATISTICS FOR THE PROPOSED

NORTH BAY AQUEDUCT ALTERNATIVE ALIGNMENTS

	1	2	2A	3	4	5	6	7
ANNUAL DELIVERY (ac ft)	61,400	61,400	61,400	61,400	61,400	61,400	61,400	61,400
PIPELINES								
1st Pipe Size								
Flow (cfs)	115	115	115	115	115	115	115	115
Diameter (inches)	60	60	60	60	60	60	60	60
Length (ft)								
N. Cordelia Forebay	122,800	60,000	95,200	134,500	121,400	121,500	88,400	124,700
S. Cordelia Forebay	.	54,100	89,900	128,600	115,500	115,600	76,700	118,800
2nd Pipe Size								
Flow (cfs)	40	40	40	40	40	40	40	40
Diameter (inches)	36	36	36	36	36	36	36	36
Length (ft)								
N. Cordelia Forebay	8,500	8,500	8,500	8,500	8,500	8,500	8,500	8,500
S. Cordelia Forebay		10,400	10,400	10,400	10,400	10,400	10,400	10,400
CANALS								
Flow (cfs)		115					115	
Length (ft)		35,800					38,900	
Top Width (ft)		19					19	
Bottom Width (ft)		4					4	
Depth (ft)		5					5	
PERMANENT R/W EASEMENT AND FEE TITLE EASEMENT (acres)	120	193	134	120	110	110	159	110
IMPROVED CHANNEL								
Flow (cfs)		105	105					
Length (ft)		9,900	9,900					
Top Width (ft)								
Bottom Width (ft)								
Depth (ft)								
PUMPING PLANTS NUMBER	2	3	2	2	2	2	3	2
1st Plant								
Flow (cfs)	115	115	115	115	115	115	115	115
Lift (ft)								
N. Cordelia Forebay	204		172	218	203	203		206
S. Cordelia Forebay			121	167	151	152		155
2nd Pumping Plant		36					63	
Energy (KWH/ac ft)	181	44	98	133	121	122	64	124
2nd Plant								
Flow (cfs)	46	115	46	46	46	46	115	46
Lift (ft)								
N. Cordelia Forebay	393	106	393	393	393	393	133	393
S. Cordelia Forebay		55	444	441	441	441	55	441
Energy (KWH/ac ft)	464	38	521	521	521	521	38	521
3rd Plant								
Flow (cfs)		46					46	
Lift (ft)								
N. Cordelia Forebay		393					393	
S. Cordelia Forebay		441					441	
Energy (KWH/ac ft)		521					521	
ANNUAL ENERGY USED (MWH)	19,816	15,314	16,260	18,253	17,579	17,584	16,493	17,748
TURNOUTS NUMBER	4	4	4	4	4	4	4	4
1st Turnout (cfs)	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9
2nd Turnout (cfs)	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7
3rd Turnout (cfs)	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4
4th Turnout (cfs)	31.4	31.4	31.4	31.4	31.4	31.4	31.4	31.4
TERMINAL FOREBAY	YES	YES	YES	YES	YES	YES	YES	YES
NUMBER OF ROAD CROSSINGS	27	12	12	12	13	13	[illegible]	16
NUMBER OF RAILROAD CROSSINGS	4	2	2	2	2	2	2	2
LENGTH THROUGH URBAN AREA	17,400	4,000	4,000	4,000	4,000	4,000	4,000	4,000

for a buried pipeline and a 90-foot permanent easement and fee title purchase for an open canal. /1/ Where not currently available, an access road approximately 15 feet in width would have to be constructed along the right of way. It should be noted, however, that 20 feet would be the minimum width requirement for a permanent easement to place a short section of buried pipe. An additional 40-foot wide (20 feet on each side) temporary construction easement would be required for both a buried pipeline and an open canal.* Pump stations proposed along the alternative alignments would be above-ground concrete structures requiring a total area of approximately one acre each.

4.2.3 For each buried pipeline alternative alignment, the above-ground surge tank (a steel tower approximately 40 feet high and 17 feet in diameter functioning to equalize water pressure in the pipe) would be constructed at the place of highest elevation. In addition, above-ground "blow-off" pipes (concrete structures approximately 3 feet high and 4 feet in diameter which would function as emergency water release valves) would be constructed at every location where a buried pipeline would encounter an elevational low point or cross a stream. Blow-off pipes in urban areas will be fenced to screen them from children. A diagram of a typical surge tank is presented in Appendix B (Figure 5).

4.2.4 There are two possible locations for the terminal reservoir. The first location (North Cordelia Forebay) would place the reservoir north of Highway 80 near the existing interim terminal reservoir for the Solano Project (Figure 4-1). The second location (South Cordelia Forebay) would place the reservoir south of Highway 80 and east of Highway 680 near the boundary of Suisun Marsh. Either terminal reservoir location would be adjoined by a pumping plant (Cordelia pumping plant) which would deliver water through a smaller pipeline to the existing Cordelia surge tank. From the surge tank, water would be delivered to Napa County via the existing Phase I facilities of the North Bay Aqueduct.

4.2.5. The possibility of two terminal reservoir locations requires that all alternative alignments except Route 1 have two possible legs diverging near Cordelia Hill to reach either a North or South Cordelia Forebay (Figure 4-1). The northern leg option for Routes 2 through 7 was designed primarily to avoid traversing the Suisun Marsh near Cordelia Hill. Route 7 would still traverse the eastern portion of the Marsh near Denverton.

4.2.6 Both initial and maintenance dredging would be required at all alternative intake locations. An intake and pumping plant on Lindsey Slough would require the dredging of approximately 300 cubic yards of material in the immediate vicinity of the proposed intake structure to provide for a channel depth of -12 feet Mean Sea Level (MSL). An intake and pumping plant on Cache Slough would require removal of approximately 30,000 cubic yards of material to provide for a channel with a depth of -12 MSL. The length of the channel which would be required to "clear" Cache Slough for the intake would be approximately 0.5 miles /3/ An intake and pumping plant on Calhoun Cut would necessitate the dredging of approximately 168,000 cubic yards of material along its entire length (approximately 3.5 miles) to create a channel with a depth of -8 MSL. Side slopes for channel dredging at all intake locations would be designed for 3:1 (horizontal to vertical). Maintenance dredging would be required approximately once every 10 years for a Lindsey Slough intake with more frequent maintenance dredging required on either Cache Slough or Calhoun Cut (perhaps as frequently as every 5 years).

*Temporary construction of right of way requirements along some of the eastern portions of Route 1 would require a slightly greater (50-foot) easement. /2/

4.2.7 The construction period would be comparable for all alignments, with an estimated time for completion of two years. The construction activities would take place in phases, with no more than 10 miles of the route under construction in any one phase. The construction period for the segment of alternative Route 1 passing through Fairfield would be about 9 months. Construction of the North Bay Aqueduct is tentatively scheduled to commence in early 1982.

4.3 COST COMPARISON

4.3.1 The estimated costs for construction and operation of Phase II aqueduct facilities are presented in Table 4-3. All costs are in 1980 dollars. Estimated costs for construction of the alternative alignments for the proposed aqueduct facilities range from $25.7 million to $43.6 million.

Construction costs for those alignments which would incorporate an open canal in the eastern portion of the aqueduct are substantially less than those routes which would incorporate a pipeline for the entire aqueduct length. However, mitigation and secondary costs reduce this difference considerably. Total annual operation and maintenance costs in 1990 would range from $1.3 to $1.5 million. /5/

4.3.2 The estimated costs for construction and operation of secondary water transport systems, which would deliver water from the aqueduct to the principal water purveyors in Solano County (Fairfield, Vacaville, and Suisun City), would be paid for by the individual water purveyors. As indicated in Table 4-3, the cost of delivery of aqueduct water from the Route 1 alignment to the individual water purveyors would be substantially less than the cost of delivery from an aqueduct along the Route 2 through 7 alignments. Estimated operation and maintenance costs for the secondary water transport systems would follow a similar trend.

4.3.3 Based on estimated construction costs, operation costs, and future project interest rates, the annual fixed costs of State Water Project water delivered through the North Bay Aqueduct in year 2000 will be $3,531,000 for Solano County and $3,187,000 for Napa County. The cost, including the variable (pumping) costs, for delivery of full entitlement would be $3,966,000/year to Solano or $109/acre-foot. For Napa, the cost of full entitlement delivery would be $4,222,000 or $169/acre-foot. At Napa's currently estimated delivery of 13,750 acre-feet in 2000, total annual costs would be $3,756,000 or $273/acre-foot. /6/ These figures include estimated cost increases due to inflation. Possible mitigation costs, other than fish screens as mandated by State law, are not included.

4.4 SPECIFIC ALIGNMENT DESCRIPTIONS

Route No. 1

4.4.1 Delta water would be diverted from Cache Slough near the City of Vallejo's existing and currently operating intake pumping station. A 60-inch diameter buried pipe would transport the water northwest, following property lines where possible, to the intersection of Meridian Road and the Sacramento-Northern Railroad line. Along this stretch the pipeline would parallel the northern boundary of the Jepson Prairie for an approximate distance of 21,000 feet. The pipeline would then turn and run southwest for approximately 4,000 feet before turning west to parallel the existing Sacramento-Northern Railroad line. Upon reaching the city limits of Fairfield, where the abandoned Sacramento-Northern Railroad tracks have been removed, the pipeline would run southwest along the northerly edge of the former Sacramento-Northern Railroad right of way, now owned by the City of Fairfield. The pipeline would pass under Interstate 80 (possibly [illegible]

TABLE 4-3

ESTIMATED CONSTRUCTION AND ANNUAL OPERATION/MAINTENANCE
COSTS FOR NORTH BAY AQUEDUCT ALTERNATIVE ALIGNMENTS
(Thousands of Dollars)

	Alternative Alignments							
	1	2	2A	3	4	5	6	7
CONSTRUCTION COSTS:								
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Pumping Plants								
Cache Slough	[illegible]			[illegible]				
Calhoun Cut		624	700					
Lindsey Slough					[illegible]	[illegible]	624	[illegible]
Travis		1,024					1,024	
Cordelia	860	1,055	1,055	[illegible]	[illegible]	1,055	[illegible]	[illegible]
Pipelines	[illegible]	[illegible]	21,043	29,663	[illegible]	26,757	[illegible]	[illegible]
Canals		[illegible]				[illegible]		
Channel Improvements		482	482					
Cordelia Discharge Line	1,160	[illegible]	[illegible]	1,521	[illegible]	1,521	1,521	1,521
Contingencies	3,352	[illegible]	2,509	3,453	[illegible]	3,074	2,492	3,143
Construction Supervision (15	[illegible]	[illegible]	3,763	5,179	4,606	4,611	3,738	4,714
Right of way	[illegible]	330	288	412	370	370	416	383
	[illegible]	[illegible]	31,648	[illegible]	[illegible]	[illegible]	31,565	39,665
MITIGATION COSTS:[a]		[illegible]	3,450	575	1,150	1,150	1,150	575
	[illegible]	[illegible]	35,098	44,145	39,918	39,945	[illegible]	40,240
SECONDARY CONSTRUCTION:[b]								
Vacaville	[illegible]	[illegible]	4,480	4,480	4,480	4,480	4,480	4,480
Fairfield	[illegible]	[illegible]	9,500	9,500	9,500	9,500	9,500	9,500
Suisun City	600	3,250	3,250	3,250	3,250	3,250	3,250	3,250
TOTAL:[c]	49,354	46,346	52,328	61,375	57,148	57,175	49,945	57,470
ANNUAL OPERATION AND MAINTENANCE:[d]	1,484	1,139	1,215	1,339	[illegible]	1,295	1,208	1,305
SECONDARY POWER:								
Vacaville	46	88	88	[illegible]	[illegible]	[illegible]	88	88
Fairfield	0	100	100	100	[illegible]	[illegible]	100	100
Suisun City	6	15	15	15	[illegible]	15	15	15
TOTAL ANNUAL:	1,536	1,342	1,418	1,542	[illegible]	1,498	1,411	1,508

a/ Based on estimate by Department of Parks and Recreation of acreage that may be required for mitigation of adverse impacts. Cost estimated at $1150/acre.

b/ All secondary costs (construction and power) based on letter from Stoddard & Associates to George Deatherage, DWR, February 20, 1980. There would not be a material difference between a northern vs. a southern terminal reservoir as regards the cost and operation of a secondary transport system for the City of Benicia.

c/ Add $750,000 to alignments 2-7 if pipeline cannot be constructed in BCDC's primary marsh zone and must be realigned around Nelson Hill east of Cordelia Junction.

d/ Based on estimates of minimum variable operation, maintenance, power, and replacement charges in 1990 for the Solano and Napa County Flood Control and Water Conservation Districts. (7) Does not include costs of maintenance dredging or disposal of dredged material.

the existing railroad tunnel) and continue southwesterly to a point where the railroad right of way swings north towards Willota. At this point the pipeline would continue approximately 7,200 feet southwest parallel to Interstate 80 and then west and northwest (5,600 feet) to the North Cordelia Forebay and pumping plant. From the pumping plant, a 36-inch pipeline would run southwest for 8,400 feet (from the North Cordelia Forebay) to the Cordelia Surge Tank. An extension of the existing Fairfield linear park bikeway could be constructed over the pipeline in the urban Fairfield area.

Route No. 2 (2A)

4.4.2 The diversion for Route 2 would take place near the western end of Calhoun Cut. From this point, water would be transported through either an open lined canal (Route 2) or a 60-inch buried pipeline (Route 2A) southwesterly to Creed Road. The alignment would then run alongside Creed Road, and in the case of a canal, around the southern side of a small hill over which Creed Road passes and then proceed west to the proposed Travis Pumping Plant site. Route 2A, the buried pipeline, would continue along Creed Road until its intersection with Meridian Road. For Route 2 the water would be lifted about 55 feet at the Travis Pumping Plant and transported through a 60-inch buried pipe westward through Suisun City. The alignment would then run southwest across the northern boundary of Suisun Marsh to the South Cordelia Forebay and pumping plant site. A 36-inch pipeline would run northwesterly 10,400 feet to the Cordelia Surge Tank. Alternatively, the alignment would bypass the northern boundary of Suisun Marsh by transporting the water north at Thomasson, travel under Interstate 80 and terminate at the North Cordelia Forebay and pumping plant site. From the North Cordelia Forebay, the water would be pumped through a 36-inch pipe southwest 8,400 feet to the Cordelia Surge Tank.

Route No. 3

4.4.3 The diversion point for Route 3 would be identical to that for Route No. 1 (i.e., Cache Slough). Water would be pumped through a 60-inch buried pipeline northwest to the intersection with the Sacramento-Northern Railroad line and then west for approximately 11,400 feet along the northern boundary of the Jepson Prairie. The pipeline would then turn southwest through the northwest corner of the prairie until paralleling the eastern boundary of Travis AFB. The pipeline would then turn south and run parallel to Meridian Road to a point just south of Creed Road. The pipeline would then turn west, following the identical alternative alignments as those proposed for Routes 2 and 2A.

Route No. 4

4.4.4 Delta water would be pumped from a point on Lindsey Slough immediately east of an existing irrigation channel on the Peterson Ranch. The Lindsey Slough pumping plant would lift the water into a 60-inch diameter buried pipeline that would run along the east side of the irrigation channel, then paralleling Robinson Road to the south. The pipeline would then travel west under Creed Road to its intersection with Scandia Road and then turn southwest to the Travis pumping plant site. From the Travis pumping plant to either North or South Cordelia Forebay, the Route 4 alignment would be identical to those proposed for Routes 2, 2A, and 3.

Route No. 5

4.4.5 Route 5, a buried pipeline with a diversion point on Lindsey Slough would have an identical alignment as Route 4 except that it would parallel Creed Road along the south rather than following directly underneath the road. From the Travis pumping plant, the Route 5 alignment would become a buried pipeline and

would be identical to that proposed for Routes 2, 2A, 3, and 4.

Route No. 6

4.4.6 Delta water would be pumped from the same diversion point on Lindsey Slough as that proposed for Routes 4 and 5. The water, however, would be transported in an open, lined canal along the same alignment as Routes 4 and 5, parallel to Creed Road up to a point approximately 16,800 feet from its intersection with Scandia Road. At this point the alignment would be routed around a hill that Creed Road traverses and then travel west to the Travis pumping plant. From the Travis pumping plant, the alignment for Route 6 would become a buried pipeline and would be identical to those proposed for Routes 2, 2A, 3, 4, and 5.

Route No. 7

4.4.7 Water would be pumped from Lindsey Slough at the same location as for Routes 4, 5, and 6. The alignment of the 60-inch buried pipeline would be identical to Routes 4, 5, and 6 until the intersection of Creed Road and Highway 113. From Highway 113, the pipeline would run southwest across the Jepson Prairie to a point near the intersection of Lambie and Goose Haven Roads, approximately two miles east of Denverton. From this point, the pipeline would run west along the southside of Lambie Road to its intersection with Highway 12, then travel northwest along Highway 12 to Scandia Road. The pipeline would then be routed west to the Travis pumping plant. From the pumping plant the alignment for Route 7 would be identical to those proposed for Routes 2, 2A, 3, 4, 5, and 6.

REFERENCES CITED:

/1/ Personal communication; Hyde, Herb; Department of Water Resources, Division of Design and Construction.

/2/ Ibid.

/3/ Ibid.

/4/ Personal communication; Quissenberry, John; Department of Water Resources, Division of Design and Construction.

/5/ Personal communication; Porterfield, Rennie; Department of Water Resources, Central District.

/6/ Ibid.

/7/ Personal communication; Curtis, Don; Public Works Director, City of Benicia.

/8/ Personal communication; Porterfield, Rennie; Op cit.

5.0 AFFECTED ENVIRONMENT

5.1 LAND RESOURCES

5.1.1 TOPOGRAPHY

5.1.1.1 The project area is generally flat, with hilly areas to the west and the south.* Between Lindsey Slough and Denverton, vernal ponds (see 5.2.1.1 Hydrology, Surface Water) are located in swale topography. This topography is characterized by a faintly billowing land surface with low coalescent mounds 6 to 12 inches higher than the adjacent depressions. /1/

5.1.1.2 North of Travis AFB, several small hills range in elevation up to 180 feet above mean sea level. South of Travis AFB, the topography is level, with elevations of between 20 and 30 feet. Further to the south, Suisun Marsh is at or just above sea level, while the Potrero Hills rise to an elevation of about 400 feet with slopes of 30 percent or more. Between Fairfield and Cordelia the project area is generally level except for Nelson Hill, which rises to approximately 300 feet. West of Cordelia elevations increase to about 200 feet.

5.1.2 GEOLOGY

5.1.2.1 Geomorphic Processes

5.1.2.1.1 The project area is located in and just west of Sacramento Valley. The Sacramento Valley and the San Joaquin Valley to the south form the Great Central Valley of California. In the level, low-lying areas of the project corridor, occasional flooding leads to sedimentation of the floodplains by the deposition of fine-grained material.

5.1.2.1.2 Erosion would be expected primarily in the hilly portions of the project area, although erosion would also be expected in level areas when fields are fallow and heavy rain falls. Streams in the area erode material from the western and southern hills and transport the sediment downstream to the sloughs and marsh. Deposition occurs in stream channels or sloughs when the speed of the water slows sufficiently to deposit suspended material. Such a sedimentation process has been increasingly apparent in Cache Slough during the past several years (see Section 5.2.1.3.4).

5.1.2.2 Surficial Deposits

5.1.2.2.1 Most of the project area is covered by younger and older alluvium with scattered outcrops of the Tehama and related rock formations (Figure 5-1). The younger alluvium consists predominantly of floodplain deposits, largely composed of silt and fine sand, while also including sand, silt, gravel, and clay. The younger alluvium also contains areas of stream channel deposits which consists of sand and gravel deposited in streams. The material is generally less than 25 feet thick in most places and is generally above the saturated zone. The soils in the project area developed on the younger alluvium are fine-grained with poor surface drainage and low percolation rates.

5.1.2.2.2 The older alluvium is a heterogeneous sequence of stream-laid deposits. The material consists of silty clay, gravel, and sand. The fine-grained deposits predominate in most of the older alluvium with gravel and sand occurring as tongues and lenses. The materials are loose to moderately compacted and have

*The term "project area", means the general vicinity of the proposed aqueduct alignments in Solano County.

developed a mature soil which contains a layer of dense clay. The permeability of the older alluvium varies considerably, being high in the areas of sand and gravel and low where fine-grained materials predominate, such as in the project area. Older alluvium covered by well- developed soils tends to transmit water slowly because of the clayey layers in the soil (see Section 5.1.3).

5.1.2.2.3 The Tehama Formation is located in scattered outcrops in the project area. The material forms many of the small hills in the area. The material is moderately compacted silt, clay, and silty fine sand with lenses of sand and gravel, silt and gravel, and conglomerate which has been cemented by calcium carbonate. Minor amounts of other sedimentary rocks occur in the project area. These rocks are related to the Tehama Formation and thus, are similar in character.

5.1.2.2.4 Bay Mud, a silty clay, covers the marsh areas. The Bay Mud is soft and plastic when wet and tends to shrink, harden, and become brittle when dry.

5.1.2.2.5 The Montezuma Formation consists of unconsolidated deposits of sand, silt, and gravel. It is mapped on the northern edge of the Montezuma Hills (Figure 5-1).

5.1.2.3 Water-Bearing Units

5.1.2.3.1 The most important aquifers are the gravel and sand deposits within the older alluvium and in the Tehama Formation and related deposits. In the older alluvium, permeability is greater north of the project area. The water derived from the older alluvium is generally of excellent quality for irrigation, but too hard (i.e., high mineral content) to be desirable for domestic use.

5.1.2.3.2 The gravel and sand aquifers in the Tehama and related formations are less permeable than those in the older alluvium. Locally, the aquifers yield large quantities of water to irrigation wells. The water in the shallow aquifers is similar in quality to that in the older alluvium, but some water in deeper wells is found to have high sodium concentrations.

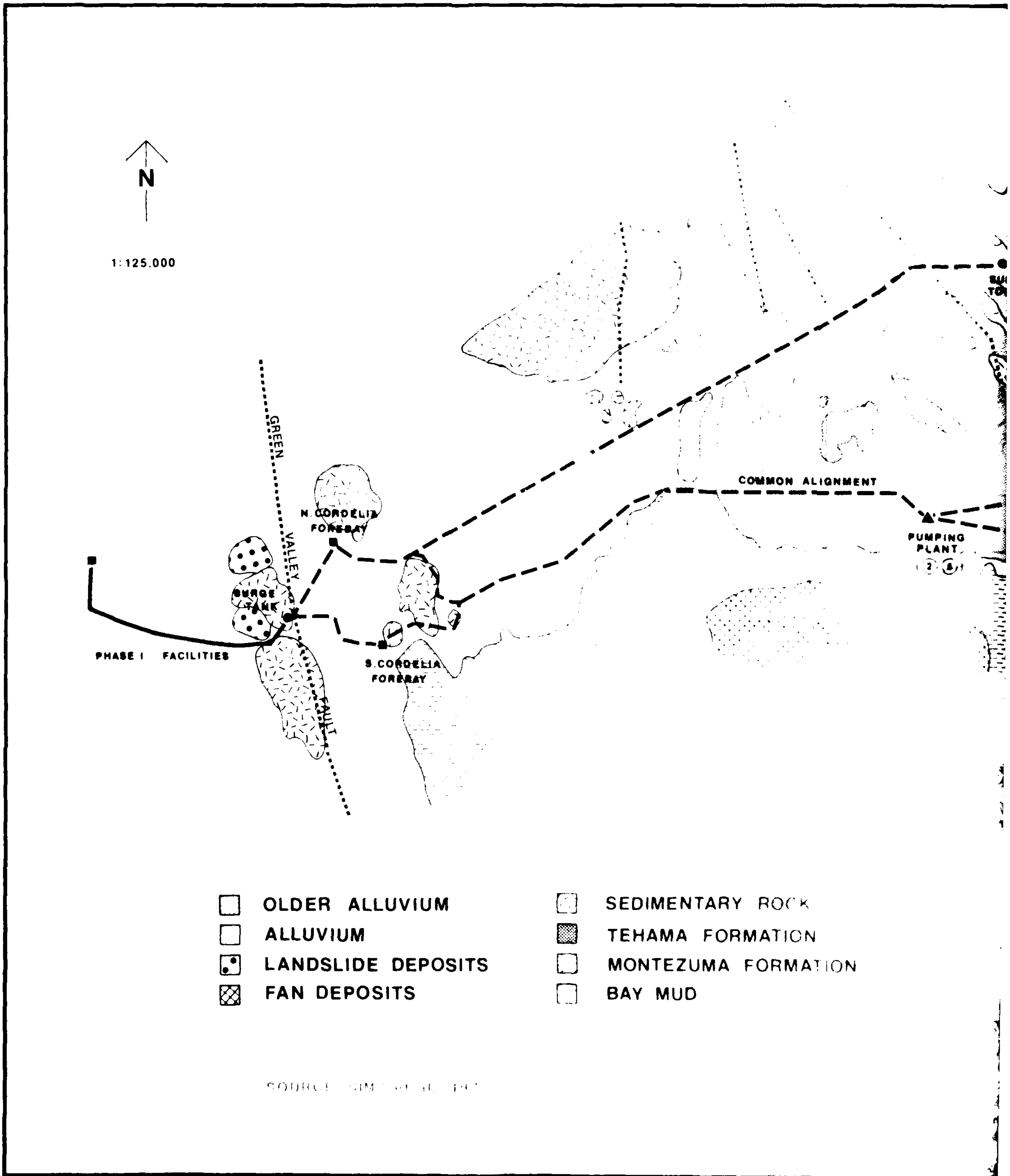
5.1.3 SOILS

5.1.3.1 Soil Associations /3/

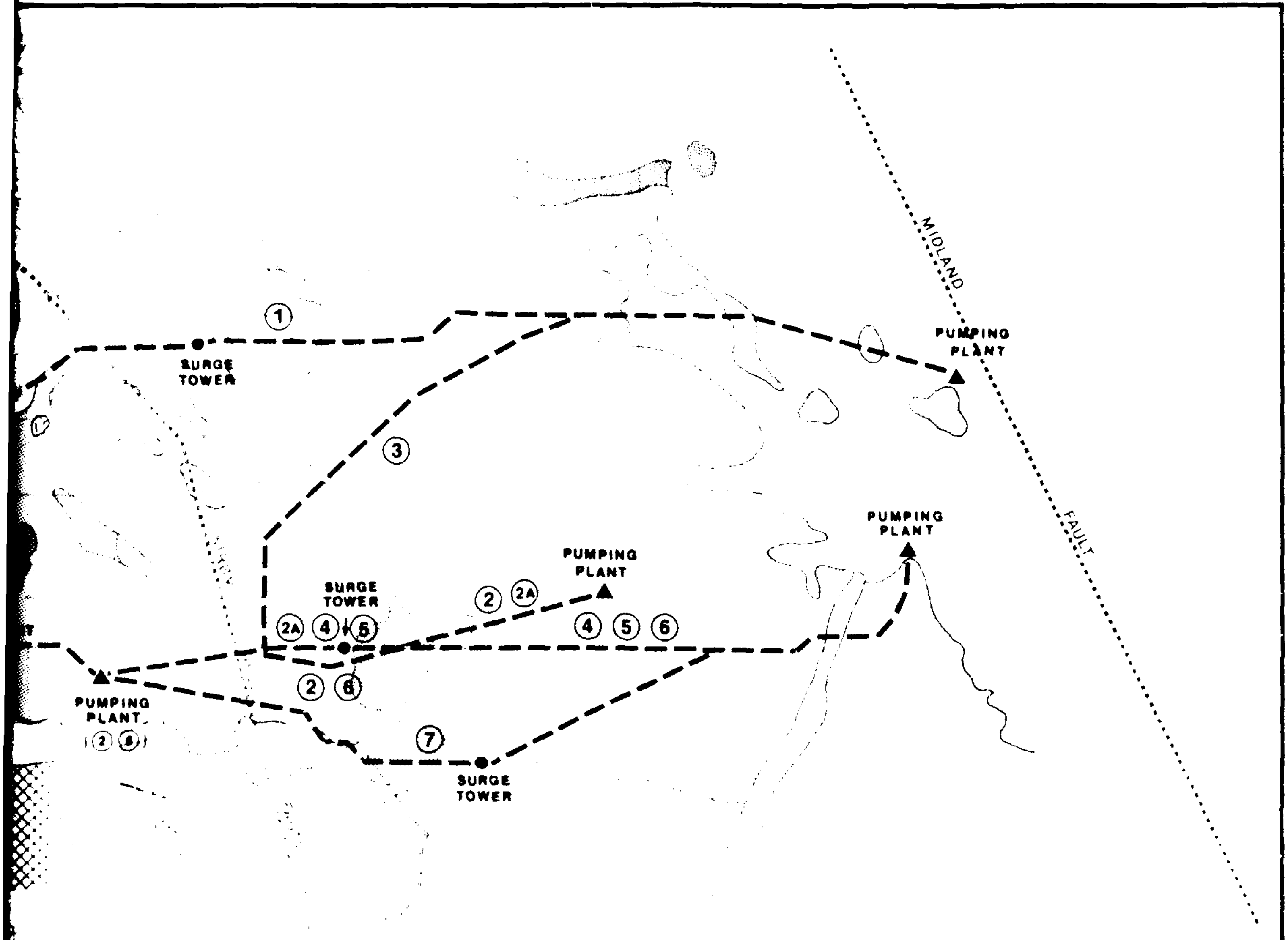
5.1.3.1.1 The soil associations in the project area are mapped on Figure 5-2 and described below. Soil associations are groups of similar soils occurring in the same topographic sequence and named for the major soil of that group.

5.1.3.1.2 The majority of the project area is covered by soils of either the San Ysidro-Antioch association or the Solano-Pescadero association. The soils have a dense clay to clay loam subsoil which restricts rooting depth and, in some areas, limits drainage. Other soils in the project area include mainly the prime agricultural soils of the Capay-Clear Lake, Yolo-Brentwood, and Yolo-Sycamore associations. In general, these soils are deep, moderately well-drained soils that were formed in alluvium and have fairly high clay contents.

5.1.3.1.3 The soils near the proposed pumping station sites on Lindsey and Cache Sloughs are mapped as the Capay-Clear Lake association. These soils are clay to clay loam in texture and have a high shrink-swell potential throughout the soil profile. Shrink-swell potential refers to the expected volume change in the soil that accompanies a change in moisture content. The soils tend to retain moisture and swell up when wet and to shrink as they dry. In general,

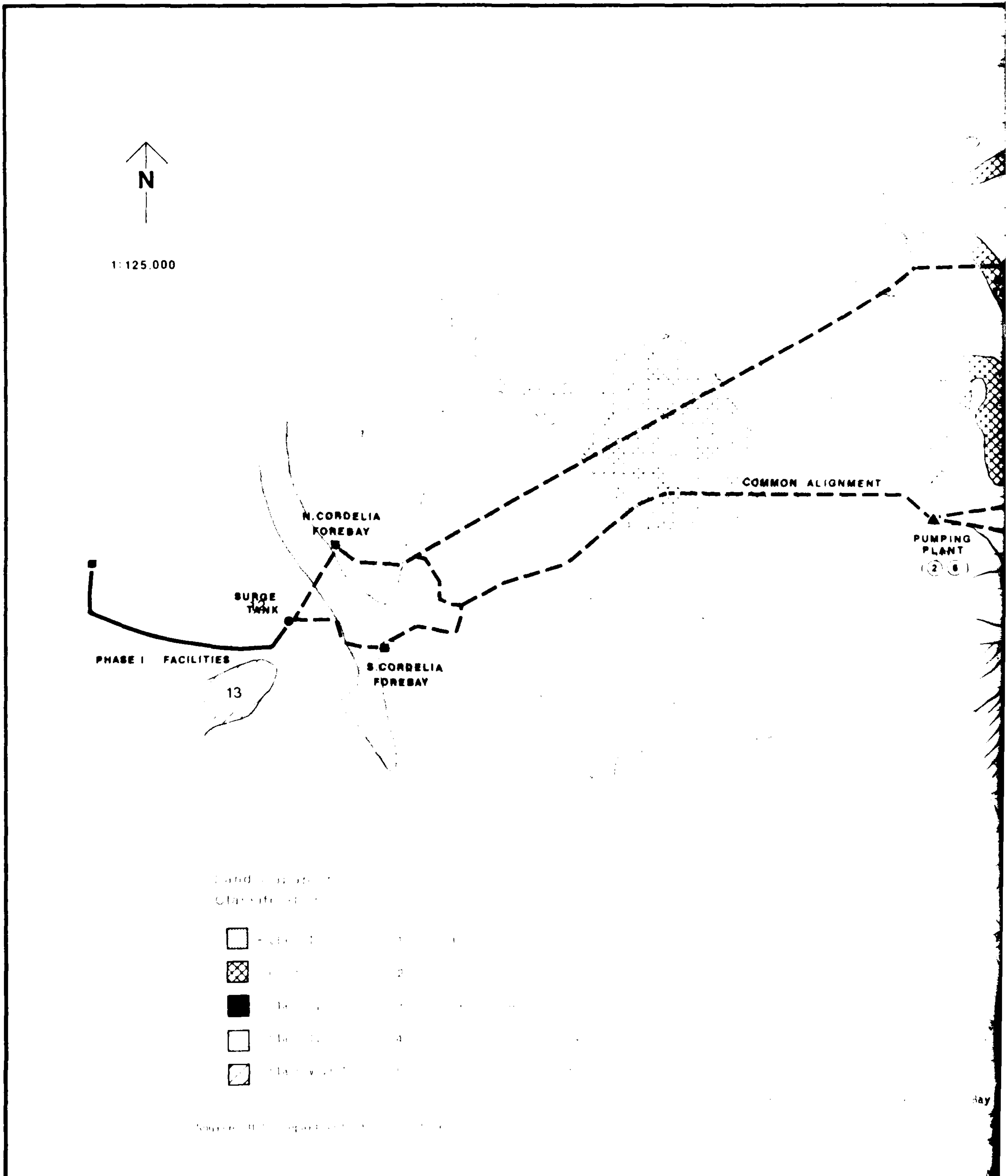


Prepared by Madrone Associates

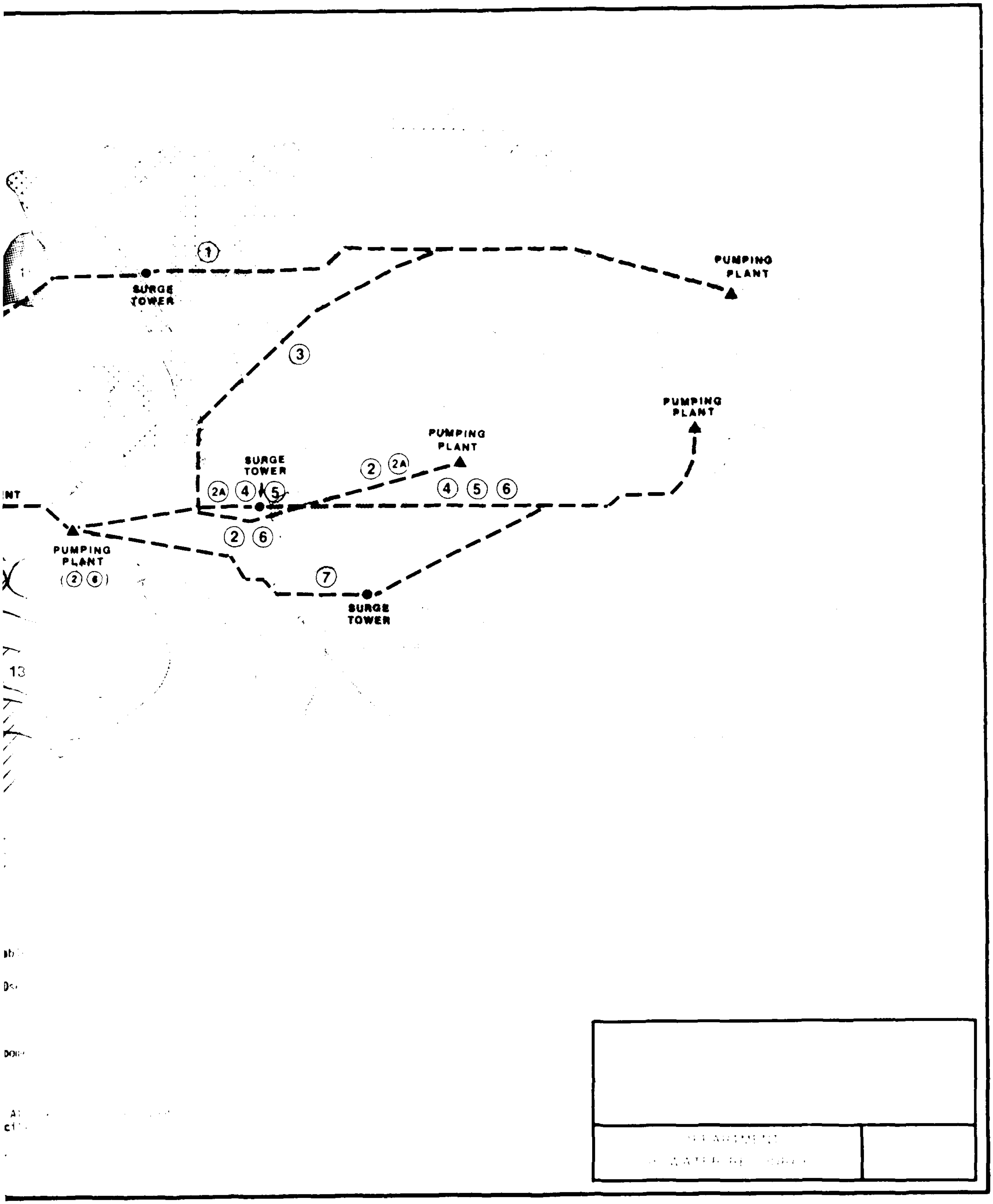


REGIONAL GEOLOGY
AND FAULT ZONES

DEPARTMENT OF WATER RESOURCES	FIG. 5-1



Prepared by Madrone Associates



1
SURGE TOWER
PUMPING PLANT
3
PUMPING PLANT
PUMPING PLANT
SURGE TOWER
2
2A
4
5
6
PUMPING PLANT
(2 6)
7
SURGE TOWER
13

soils with a high percentage of clay have a high shrink-swell potential.

5.1.3.1.4 A substantial portion of the project area is covered with soils of the moderately well-drained San Ysidro-Antioch association. These soils have dense clay or clay loam subsoils that restrict rooting depth. The soil surface horizons, to a depth of 12 to 20 inches, have a low shrink-swell potential while the dense clay subsoils have a high shrink-swell potential.

5.1.3.1.5 The Solano-Pescadero soil association is scattered throughout the eastern two-thirds of the project area. These soils are somewhat poorly drained, have dense clay subsoils and, in some areas, are saline (salt-affected). The subsoil has a high shrink-swell potential while the surface horizons have moderate to high shrink-swell potentials, depending on the clay content of a specific site.

5.1.3.1.6 Directly north of Little Honker Bay a small area of Corning association soils are located. These soils have a loamy surface about 15 to 20 inches thick with a low shrink-swell potential. However, the clay subsoil about 15 inches thick, has a high shrink-swell potential. Underlying this clay layer, generally about 30 inches below the soil surface, is dense, gravelly sandy loam with a low shrink-swell potential.

5.1.3.1.7 Altamont-Diablo soil association is found in the Potrero Hills, near Cement Hill, near Rio Vista Junction, and southwest of the proposed pumping station for Route 2. The soils are shallow to bedrock, about 25-50 inches deep, and have a high shrink-swell potential because of their high clay content. The Dibble-Los Osos association, found north of Fairfield, is also found on terraces and uplands and is shallow to bedrock. The shrink-swell potential of the soil is moderate to high.

5.1.3.1.8 The Yolo-Brentwood and Yolo-Sycamore soil associations are found near Fairfield. These soils are generally very deep soils with moderate to high shrink-swell potentials. Sycamore soils are usually artificially drained to maintain the water table at a depth greater than 60 inches.

5.1.3.2 Agricultural Capability

5.1.3.2.1 The majority of the project area is covered by agricultural soils requiring special management and crop selection. Prime agricultural land is found mainly near the Fairfield-Suisun City area and in the eastern section of the project area near Lindsey and Cache Sloughs (Figure 5-2). /4/

5.1.3.2.2 The U. S. Soil Conservation Service has established a land-capability classification system to evaluate soils by potential agricultural productivity. Soils are placed in capability groupings based on limitations of the soils when used for field crops, the response of soils to management practices, and potential damage to the soils if used for field crops.

5.1.3.2.3 Class I and Class II soils are generally considered to be prime agricultural land, because the soils have few limitations which restrict their use or require special agricultural and conservation practices. As shown in Figure 5-2, Class I and II soils are found in the project area near Fairfield-Suisun City, near Travis AFB, and near Lindsey and Cache Sloughs.

5.1.4 SEISMICITY

5.1.4.1 The San Francisco Bay region is a seismically active area. A number of faults, including two known active ones, are located in the project area (Figure 5-1). Other faults in the San Francisco

Bay area could affect the project area. /5/

5.1.4.2 The Green Valley fault is located in Green Valley approximately 6 miles west of Fairfield-Suisun City. The fault trends northwesterly and exhibits many features which indicate it is an active fault, including offset fences and power lines which indicate active fault creep, disrupted drainage patterns, and a number of small earthquake epicenters mapped along the fault trace. The Green Valley fault has a special study zone designation under the Alquist-Priolo Act of 1972. Detailed evaluation to locate the fault trace prior to construction activity and special construction measures are required. /6/

5.1.4.3 The Concord fault is another active fault, located about 12 miles southwest of Fairfield-Suisun City and south of the Carquinez Strait. The largest known earthquake on the Concord fault had a magnitude of 5.4 on the Richter scale. The fault is also located within an Alquist-Priolo Act special studies zone. /7/ The Hayward, Calaveras, and San Andreas faults are the other active faults located in the general vicinity which could seismically affect the project area.

5.1.4.4 Faults of unknown activity are also located in the Fairfield area. These faults include the Midland fault, which crosses Travis AFB, the Lagoon Valley fault, the Vaca Valley fault and an unnamed fault in the hills north of Interstate 80 along Waterman Ranch Road. Faults of questionable activity are also found at Cement Hill and in the Potrero Hills. /8/

5.1.5 OTHER GEOLOGICAL HAZARDS

5.1.5.1 Erosion

Erosion appears to be relatively limited in most of the project area. In the relatively flat portions of the project area, erosion is probably limited to sheet erosion (where the water flows in sheets, rather than in well-defined channels) and to erosion of streambank channels in small rills and gullies. In the western and southern hills erosion is probably more extensive, particularly in areas where vegetation is sparse or lacking entirely. Streams in the hills also erode the rock material downstream.

5.1.5.2 Landsliding

No mapped landslides are located in the project area. Landslides are mapped in the hills west of Green Valley, but they do not appear to be in the proposed construction area. /9/

5.1.5.3 Subsidence

Subsidence is a potential problem in the eastern portions of the project area, but that potential has not been studied. The Pacific Gas and Electric Company operates 25 to 30 wells in the vicinity of Lindsey Slough, Calhoun Cut, and Lambie Roads. /10/

In addition, Pacific Gas and Electric uses several depleted gas fields in the Rio Vista area for storage.

5.1.5.4 Liquefaction

Liquefaction is the transformation of granular water-saturated material from a solid state into a liquid state as a result of increased pressure within the material and often as a result of earthquake-induced shaking. The agricultural land between Cordelia and Fairfield is particularly susceptible to liquefaction. /11/

5.2 WATER RESOURCES

5.2.1 SURFACE WATERS

5.2.1.1 Hydrology

5.2.1.1.1 Hydrologic features in the project area include perennial and intermittent streams and lakes, sloughs, and marshlands. The majority of streams in the project area are intermittent, which means they contain flowing water during certain times of the year, usually during the rainy winter and spring seasons. The streams in the northern part of the project area originate in the eastern hills of the Coast Ranges and flow southeast and south into the sloughs and eventually into the Sacramento-San Joaquin Delta and Suisun Bay. Several of the creeks, such as Alamo Creek, are perennial (always flowing) in their upper reaches, then become intermittent as they cross the level plain area. Others, such as Sweeney Creek, are intermittent throughout their course. Some of the creeks, for example Gibson Canyon Creek, have been modified by levee construction, or channelization. In the southeastern portion of the project area, intermittent streams flow north and east from the Montezuma Hills into the sloughs and bays. The Big Ditch is a north-flowing stream.

5.2.1.1.2 Tidal sloughs, which are "swamp" waterways subject to ebb and floodflows, are located along the east central and south central portions of the project area including Haas, Cache, Lindsey, Nurse, Denverton, Suisun, and Cordelia Sloughs. Levees have been constructed around many of the sloughs. Cache and Lindsey Sloughs are connected by Hastings Cut. Lindsey Slough, extended by Calhoun Cut and Barker Slough, is generally considered to be a deadend waterway. Cache Slough is extended by Haas Slough and Ulatis Creek, which drains a major portion of the Northeast Solano County watershed area. The City of Vallejo currently diverts water for domestic use from Cache Slough, and there are numerous private agricultural withdrawals and returns from both Cache and Lindsey Sloughs.

5.2.1.1.3 The general hydraulic characteristics of Lindsey Slough are slightly different from Cache Slough during the periods of heavy precipitation and runoff when high flows from Ulatis Creek enter Cache Slough. However, during periods when Ulatis Creek is dry, both sloughs are essentially deadend water channels. Flood and ebb flows in Lindsey Slough are slightly smaller than Cache Slough, probably reflecting variations in agricultural and domestic withdrawals, evaporation, and ground water seepage. On November 27 and 28, 1979, the Department of Water Resources conducted flow measurements in Cache Slough that revealed a net ebb flow of 98 cfs. /12/ During peak usage periods (summer months), the net flow in both channels is upstream.

5.2.1.1.4 Suisun Marsh is located south of Fairfield-Suisun City. Permanent marsh areas consist of many acres of controlled marshes. These areas are diked, but the dikes are opened to allow periodic flooding. Seasonal marsh areas are evident on the outer edges of Suisun Marsh.

5.2.1.1.5 In the area between Calhoun Cut and Denverton Slough a number of vernal or springtime bodies of water are located. The term vernal pools applies to a variety of intermittent bodies of water which form in the winter and spring, but dry up by summer. The smallest of these are swales which fill with water after each rain and hold water for a few days. The swales have a diameter of a few yards and a maximum water depth of a few inches. Swales are described as faintly billowing landforms and characterized by many low, coalescent or rounded mounds that are 8 to

10 inches higher than the basin-shaped areas between them.

5.2.1.1.6 Vernal lakes are the largest water bodies which fill with rainwater during the winter and hold water for a number of weeks after the rainy season ends. The lakes may have diameters of 165 to 250 feet and a water depth up to two feet. The vernal water bodies are separated by round mounds called mima mounds. The mounds vary in basal diameter from 10 feet to more than 100 feet and in height from about 12 inches to about 7 feet. The origin of vernal pools is not completely understood. The pools tend to dry up inwardly, and in the drying process they develop concentric circles of distinctive vegetation. /13/ See Section 5.3.1.2.

5.2.1.1.7 Runoff in the winter months is mainly a result of precipitation, while runoff in the summer is mostly from irrigation drainage. Several streams in the northern part of the project area, such as Ulatis and Alamo Creeks, have been improved or realigned for flood control. /14/ Nearby farmers use creeks as a source of irrigation water and also as receptors for runoff. These creeks drain southeastward, eventually joining one of the sloughs of the Sacramento River system. In the central and western section of the project area, irrigation water comes from natural creeks, such as Union Creek. Excess runoff drains into these creeks and eventually into Suisun Marsh.

5.2.1.2 <u>Flooding</u>

Flood-prone areas in the project are mostly located near the major creeks and near the boundary of the sloughs. The eastern segment of each route originates in a flood hazard area. The southwestern portion of the project area is also flood-prone, including a large part of the area west of Barker Slough. There are flood-prone areas in Fairfield surrounding streams such as Laurel Creek which flow through the city. Most of the other proposed route alignments cross areas designated by the U. S. Department of Housing and Urban Development as "Zone A" flood-prone areas. /15/ Actual floodwater depths have not been determined in the flood-prone areas. These areas have a 1 percent probability of flooding in any given year. /16/

5.2.1.3 <u>Water Quality</u>

5.2.1.3.1 Considerable but limited water quality data are available for Cache Slough at the City of Vallejo intake, dating back to the original placement of the diversion in 1953. Weekly chloride data are available in the Vallejo Water Treatment Plant laboratory records from 1953 to the present. Total dissolved solids (TDS) measurements began in 1975. More comprehensive water quality sampling in Cache Slough was begun in September 1979 by the City of Vallejo. These data include a variety of important water quality parameters such as mineral content and organic and inorganic chemical concentrations. A summary of available water quality data is presented in Appendix C.

5.2.1.3.2 Analysis of the chloride data for Cache Slough (at Vallejo intake) and Lindsey Slough (above Liberty Island Ferry) provides an indication of the general water quality charcteristics in the region. Chloride concentrations in Cache Slough show a generally linear increase over the 1960-65 and 1970-76 periods. Since the quality of Sacramento River water (at Rio Vista) has remained relatively constant over the period, these increases in chloride concentration may reflect changes in agricultural practices in the region over many years. In the 1977-79 period, data indicate that chloride and total dissolved solids (TDS) values in Cache Slough have increased significantly. TDS and chloride concentrations are generally higher during the spring runoff period and decrease during the summer months when better quality Sacramento River water is being drawn into the upper reaches of the slough. TDS and chloride concentrations

also generally increase in an upstream direction.

5.2.1.3.3 Lindsey Slough water quality data collected from 1953 to 1965 indicates slightly better quality with respect to TDS and chloride than found for Cache Slough. Yearly average chloride and TDS values indicate a less rapid rate of increase in concentration over the same 1960-65 period than observed in Cache Slough. Seasonal variations indicate the highest TDS and chloride concentrations occur during the winter and spring months when precipitation and runoff are at peak levels. Mineral concentrations in Lindsey Slough are reported to be higher than the Sacrmento River (at Rio Vista) because of poor quality ground water seepage and irrigation return flows. /17/ A poor circulation pattern also contributes to the higher TDS and chloride concentrations found in Lindsey Slough compared with the Sacramento River.

5.2.1.3.4 Suspended solids are an important water quality parameter since many other pollutants (e.g., fecal coliform bacteria, heavy metals) are often attached to these particles. In addition to their role as carriers of other pollutants, a high level of suspended solids can create other problems such as elevating the turbidity of water and causing siltation of waterways. Cache Slough in the vicinity of the City of Vallejo's existing water intake has experienced an increasing degree of siltation in recent years, although the increase has not been quantified. Upstream agricultural practices within the Vacaville and Dixon watersheds have received some of the blame for the increased siltation in Cache Slough, although expanding urban development in the Vacaville area is undoubtedly contributing to the problem. In recent years, the City of Vallejo has had to do an increasing amount of maintenance dredging around the Cache Slough intake to keep it clear. /18/

5.2.1.3.5 Solano County has recently completed a surface runoff management plan for northern Solano County which includes the watersheds draining into Cache and Lindsey Sloughs. [illegible] the County cited a number of existing and potential problems in the Vacaville watershed, including [illegible] systems, erosion, siltation, [illegible] and litter accumulations in streams, and possible spills from toxic chemical operations (Figure [illegible]). Only erosion was cited as a potential problem in the Rio Vista watershed, which drains largely into Lindsey Slough. In addition, [illegible] jections of future pollutant loadings in the plan indicate that Cache Slough will show greater increases than will Lindsey Slough (Table 5-[illegible]).

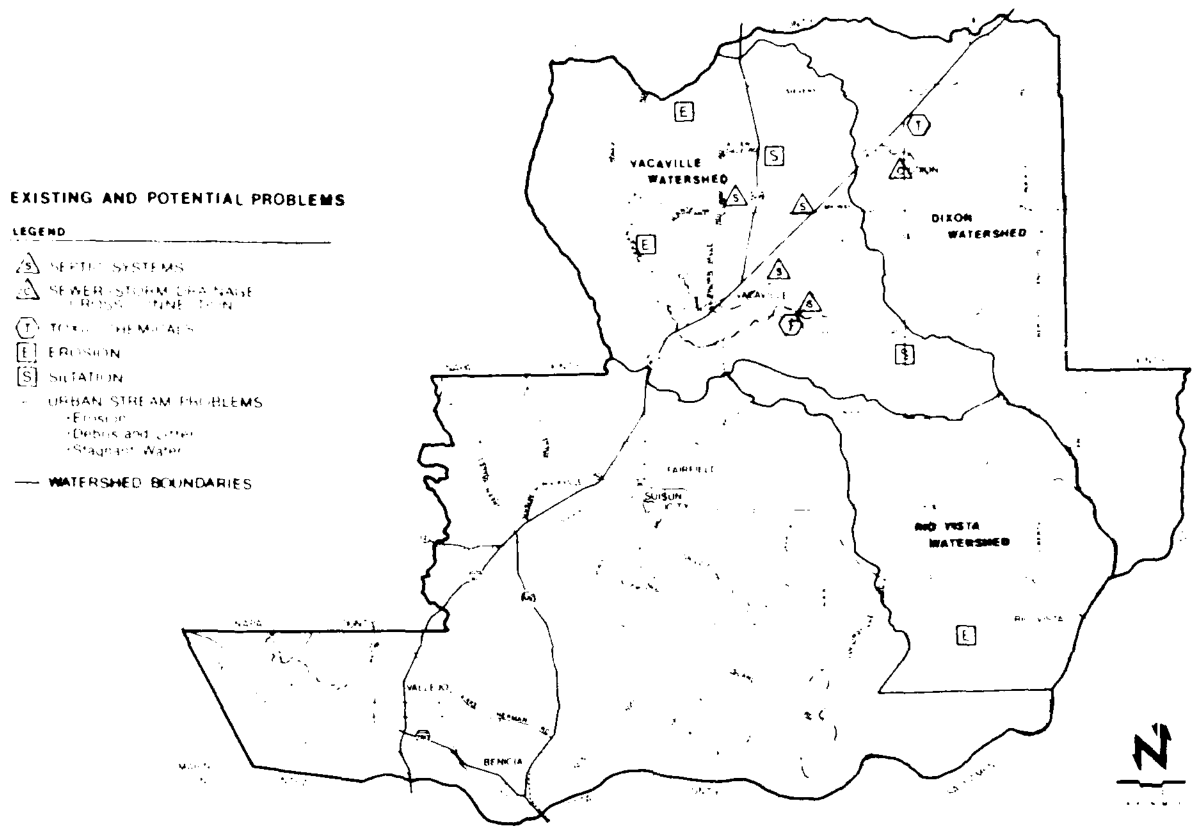
5.2.1.3.6 Although [illegible] are available on [illegible] it would be expected that TDS and chloride levels would be somewhat higher than [illegible] Slough. This is [illegible] lower hydraulic [illegible] and upstream location of the channel.

5.2.2 GROUND WATER [illegible]

5.2.2.1 Central [illegible] has two hydrogeologically separate ground water basins-- the Putah [illegible] and [illegible] Fairfield basins. [illegible] ground water between these basins is restricted by low rock ridges which extend from the Montezuma Hills northwest [illegible]. The project area [illegible] most of the Fairfield-Suisun [illegible] part of the Putah Plain basin.

5.2.2.2 In the Fairfield-Suisun basin the older alluvium, which is [illegible] feet thick, is the source of most ground water (see 5.1.2, Geology). Yield from wells in the alluvium is generally less than 200 gallons per minute. Yields from wells in the Putah Plain are generally of much higher capacity, with a range of 500 to 2,000 gallons per minute.

5.2.2.3 Ground water is replenished by percolation of rainfall, percolation of flow in Putah Creek and other streams, subsurface inflow from the west and from Yolo County, deep percolation of applied



Source: Surface Runoff Management Plan for Northern Solano County, June 1979

SURFACE RUNOFF PROBLEMS IN NORTHERN SOLANO COUNTY

FIG. 5-3

TABLE 5-1

SURFACE RUNOFF POLLUTANT LOADS
BY WATERSHEDS
(Thousands of Pounds Per Year)

	Year	Vacaville	Dixon	Rio Vista	Totals
BOD	1975	670	397	285	1,352
	1985	780	411	287	1,478
	2000	913	437	291	1,641
TSS	1975	66,950	46,544	32,502	145,996
	1985	66,558	46,494	32,501	145,553
	2000	65,713	46,328	32,499	144,540
TN	1975	298	[illegible]	135	624
	1985	321	194	136	651
	2000	347	199	137	683
TP	1975	70	47	33	150
	1985	73	47	33	153
	2000	74	48	34	156

SOURCE: Northern Solano County. June, 1979. Surface Runoff Management Plan, Appendices.

Key:
BOD - Biological Oxygen Demand
TSS - Total Suspended Solids
TN - Total Nitrogen
TP - Total Phosphorus

irrigation waters, and losses from distribution and drainage canals. The younger alluvium and stream channel deposits provide excellent ground water recharge in areas where the soils are not too clayey.

5.2.2.4 The total storage capacity of the aquifer interval 20 to 200 feet is 1,952,000 acre-feet, with 1,712,000 acre-feet in the Putah Plain basin and 226,000 acre-feet in the Suisun-Fairfield area. However, only approximately one-half the total storage capacity may be usable because of water quality contaminants. Both basins have an estimated safe pumping yield that ranges from 106,000 to 159,700 acre-feet/year.

5.2.2.5 Ground water levels vary through the project area. The ground water movement is generally toward the sloughs and marshes to the east and south. The highest ground water levels are found west and south of Fairfield and Suisun City. High ground water levels may also be found in the northernmost portion of the project area, which is part of the Putah Plain ground water basin. High ground water levels also occur near the sloughs.

5.2.2.6 Ground water is used extensively in the portions of Solano County where it is available. The use of ground water in Napa County is generally limited because of small aquifers and low well yields. /20/ (Also see Section 3.2.2.2.)

5.3 BIOLOGICAL RESOURCES

5.3.1 VEGETATION

5.3.1.1 General Characteristics

The dominant vegetation type in the project area is grassland. Some of the land has been leveled, while other portions are unmodified. In both cases, the land is used primarily to produce grasses as forage for cattle and sheep. Vernal pools are present in parts of the unmodified grassland in the eastern portions of the project area. These pools support a characteristic flora dominated by various species of annual plants. Some land is used for intensive agriculture, particularly within the Cache Slough watershed area. Corn and sugarbeets are the most common crops, while orchards are also present. The major sloughs within the project area (Cache Slough, Lindsey Slough, Calhoun Cut) have riparian vegetation (willows, alders, and shrubs) growing along their banks. Riparian vegetation can also be found along some of the larger creeks. Eucalyptus trees have been planted in various locations throughout the area to serve as windbreaks. The northern portion of the Suisun Marsh lies within the project area, containing seasonally flooded grasslands, riparian vegetation, freshwater marsh, and small areas of pickleweed.

5.3.1.2 Distinctive Communites

5.3.1.2.1 Vernal Pools. Vernal pools form in small, hardpan-floored depressions in the valley grassland. The pools fill with water during the winter, then gradually dry up in the spring and summer. As the pools dry, various species of annual plants flower along the margin. Vernal pools are common in the Jepson Prairie area, forming in areas of semi-rolling landscape with alternating hummocks and depressions (see Plate 4a). The areal extent and size of individual pools vary considerably; pools as small as 1-2 square metres are common. /21/ The location of the major vernal pools within the project area is shown on map segment Figures 6-1 to 6-11.

5.3.1.2.2 At least 200 plant species are known to occur typically in vernal pools -- over 70 percent of which are native to California. In addition, many of these species appear to be entirely restricted to vernal pools. /22/ Shallow pools are

usually dominated by plants such as Limnanthes or Lasthenia spp., while slightly deeper pools are dominated by Downingia sp. Some of the deepest pools support plants such as Neostapfia, Orcuttia, Lagenere, and Orthocarpus. /23/ These and other vernal pool genera include several rare, threatened, or endangered plant species.

5.3.1.2.3 Riparian Vegetation. The most significant areas of riparian vegetation in the eastern portion of the project area occur along Calhoun Cut, Lindsey Slough, and to some extent, Cache Slough. Willows and cottonwoods are a characteristic vegetative feature along Calhoun Cut (see Plate 3a). Tules and other emergent vegetation are also present at the upper end of Calhoun Cut. The small islands in Lindsey Slough are heavily vegetated with trees, such as alders, willows, and cottonwoods, and other native vegetation (Plate 1a). The highly modified banks of Cache Slough are not as extensively vegetated as those of Lindsey Slough. Cache Slough has only some scattered native and introduced shrubs and trees (cottonwoods, alders, willows, and eucalyptus)(Plate 2a).

5.3.1.2.4 The western portion of the project area borders the northern margin of Suisun Marsh. The major sloughs in this portion of the Marsh support some riparian vegetation. Willows and other riparian trees are present along the northern part of Cordelia Slough as well as tules, dock, and cattails in areas of standing water (Plate 9b). Significant amounts of riparian vegetation also occur along Denverton Slough.

5.3.1.2.5 Jepson Prairie. The Jepson Prairie generally encompasses the area east of Travis AFB, south of Cache Slough, and north of Highway 12 (Figure 5-4). A vegetation survey was conducted during 1979 in a portion of the Jepson Prairie area, along the proposed alignments for Routes 2 and 2A of the North Bay Aqueduct. /24/ The area is dominated by native grassland and vernal pool species (see Plate 3b). A total of 122 species of plants was recorded from the area, including 40 vernal pool species, 70 grassland species, and 12 marsh and riparian species (in and near Calhoun Cut). Two rare species were encountered in this area: vernal pool dodder (Cuscuta howelliana) and minature downingia (Downingia humilis). Miniature downingia is currently a candidate species for listing as threatened on the federal endangered species list. A more recent survey was conducted in 1980 in the vicinity of Routes 1 and 4. The results of this survey are included in Appendix D.

5.3.1.2.6 Grassland. Grasslands are the dominant vegetation type found within the project area. Most of the area east of Fairfield is covered by grassland, including the Jepson Prairie area. Some of the areas are managed to provide forage for livestock, while other grasslands are maintained in their natural state.

5.3.1.2.7 Agriculture. Most of the intensive agricultural activities are concentrated in the northeastern portion of the project area. Row crops, such as corn and sugarbeets, are the most common crops cultivated in this area. Orchards are present in the western portion of the project area (west of Fairfield and Suisun City).

5.3.1.2.8 Suisun Marsh. Suisun Marsh contains approximately 10 percent of the remaining wetlands in the State of California. The Marsh has been administratively divided into a primary management area consisting of 84,000 acres of brackish tidal marsh, managed wetlands, adjacent grasslands, and waterways, and a secondary management area, containing 22,500 acres of significant buffer lands (Figure 5-4). /25/ The tidal marsh area is dominated by tule and bulrush, plants which provide habitat for waterfowl and other animals. The northwestern portion of Suisun Marsh which is crossed by several of the proposed alternative alignments consists of a combination of managed marsh and pasture lands (see Plate 9a).

5.3.1.3 Threatened and Endangered Species

5.3.1.3.1 Only one plant species that occurs within the project area, Solano grass (Orcuttia mucronata), is currently listed by the U. S. Fish and Wildlife Service (USFWS) as an endangered species. However, several additional plant species are regarded as candidate species for listing by the USFWS, and have been designated as threatened, endangered, or species of concern. Most of the threatened and endangered species occur in the Jepson Prairie or Suisun Marsh area. The actual locations of these plants within the project area have been mapped on segment maps (Figures 6-1 to 6-11). Several of the plants are vernal pool species, including Solano grass, Colusa grass, and miniature downingia. Most of the remaining species are also characteristic of wet areas, occurring along the banks of sloughs or in marshes and wet meadows. A floristic survey of areas along the proposed North Bay Aqueduct alignments was conducted in 1980 to determine potential impacts on threatened, endangered, and unique species (see Appendix D). The survey results indicated the North Bay Aqueduct could be built without disrupting any stands of rare plants.

5.3.2 FISH AND WILDLIFE

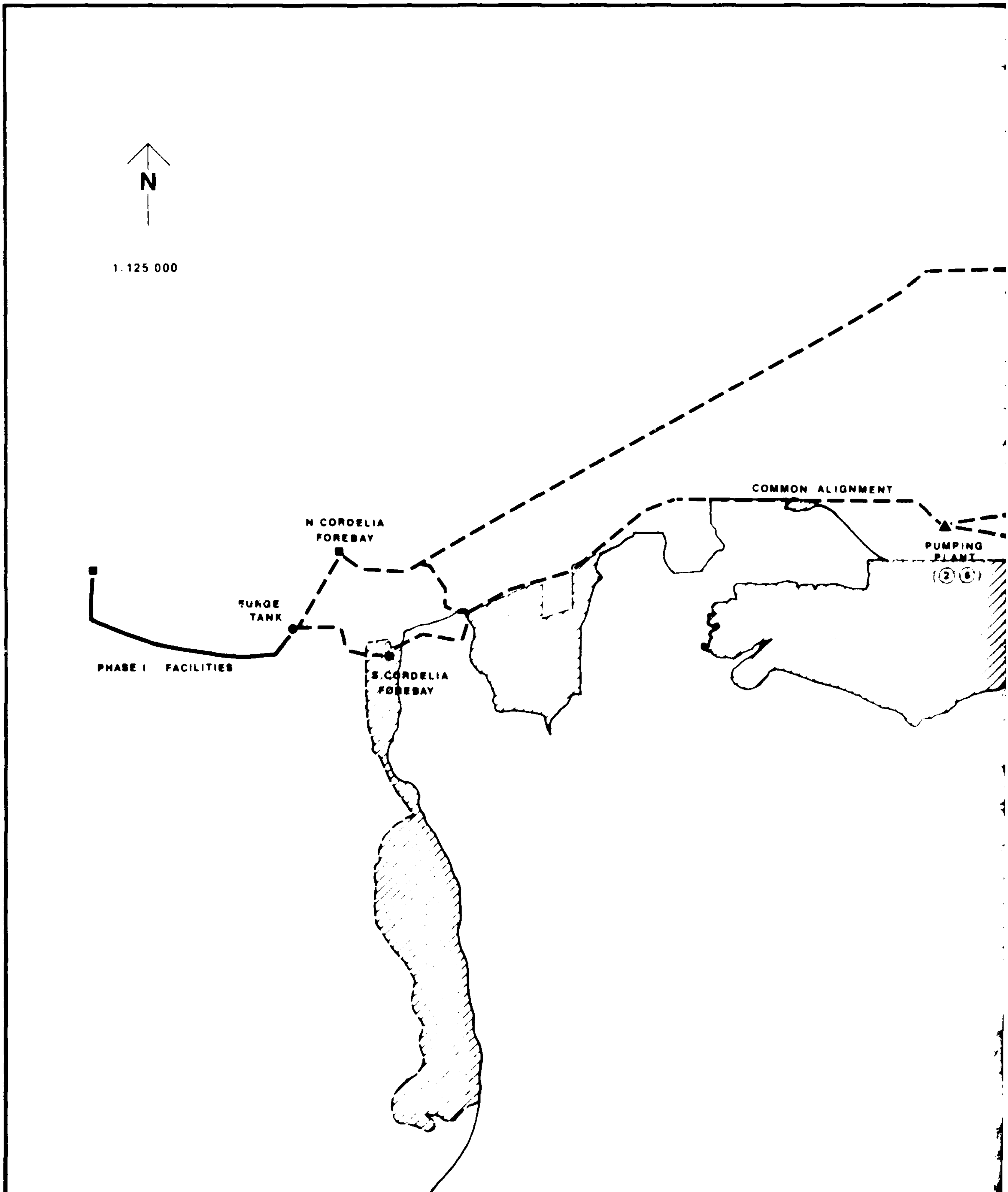
5.3.2.1 Wildlife and Domestic Animals

5.3.2.1.1 Suisun Marsh is located on the Pacific Flyway, a major route followed by migratory birds. The Marsh is not an important breeding area, but does provide critical feeding and resting areas for wintering waterfowl. Common waterfowl found in Suisun Marsh include pintail ducks, mallards, green-winged teal, wigeon, shovelers, whitefronted geese, and American coots. Upland areas provide habitat for many wildlife species including shrews, bats, raccoons, skunks, weasels, coyotes, foxes, mice, rabbits, and deer. /26/ The main domestic animals present on pasture lands are cattle.

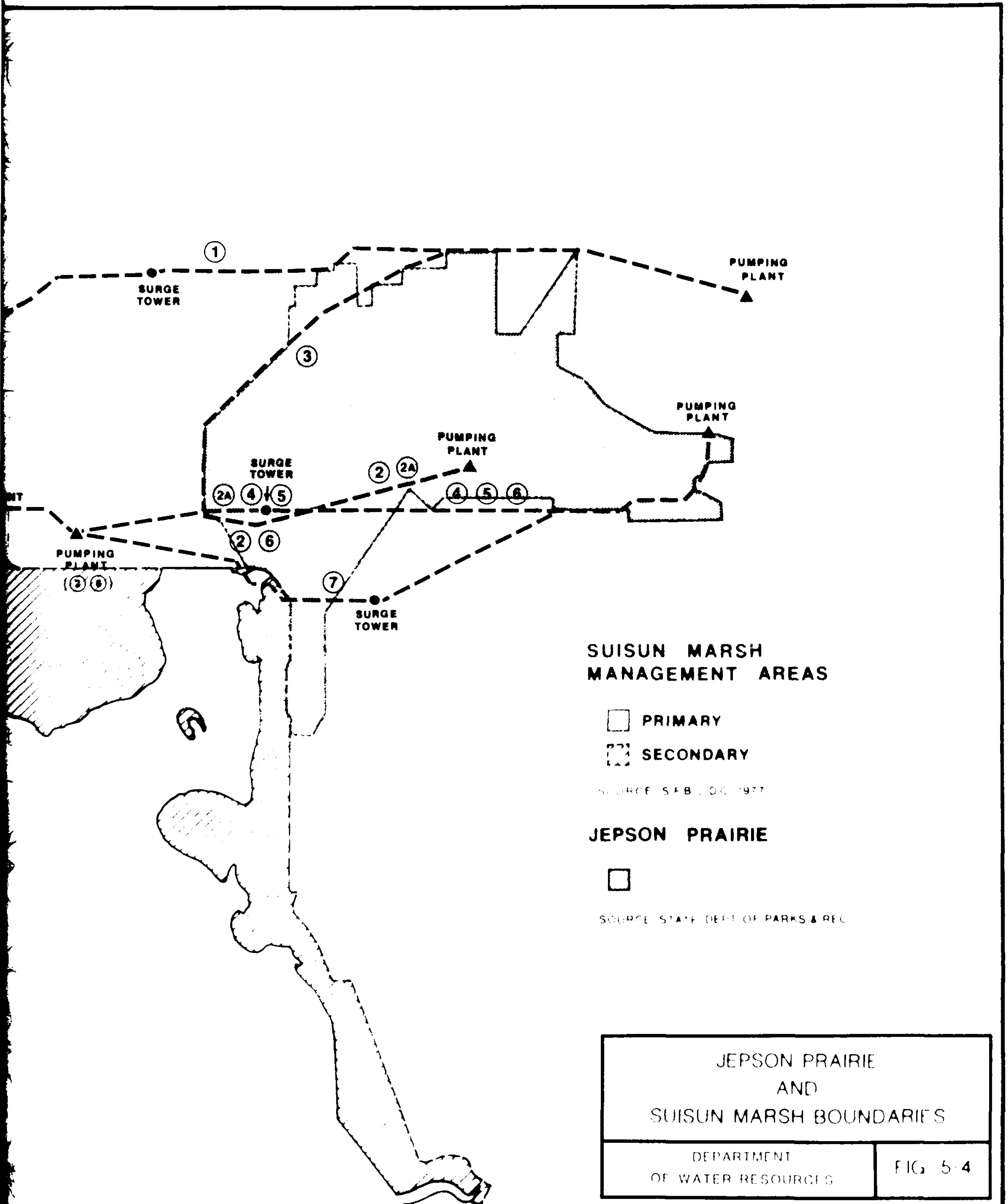
5.3.2.1.2 Riparian woodland consists of trees taller than 3 metres with a dense understory of shrubs. This habitat is present to varying degrees along the sloughs in the project area. Wildlife is abundant in this area, with 81 species of birds recorded from nearby Delta riparian woodlands. These include waterfowl, songbirds, and raptors. Mammals expected to occur in the riparian woodlands include opossums, moles, and skunks. /27/ Riparian woodland provides wildlife food and cover, and is more valuable wildlife habitat than the adjacent grasslands and cultivated land.

5.3.2.1.3 The Jepson Prairie provides habitat for both wildlife and domestic animals, since it includes areas of cultivated fields, pasture land, and vernal pools. Waterfowl and shorebirds are attracted to vernal pools and flooded fields during the winter. Ducks, swans, geese, egrets, and cranes are commonly found resting and feeding in this habitat. Unflooded fields, especially cornfield stubble and pasture lands, are also valuable as a wintering habitat for birds; they provide food for geese, pheasants, quails, and doves. Many raptorial birds, such as American kestrels, while-tailed kites, red-tailed hawks, and turkey vultures, require open areas for hunting.

5.3.2.1.4 Mammals are also present throughout the Jepson prairie area. The common types include opossums, moles, black-tailed jack rabbits, ground squirrels, pocket gophers, mice, voles, coyotes, grey foxes, raccoons, weasels, and skunks. While some species (ground squirrels, pocket gophers, California



Prepared by Madrone Associates



JEPSON PRAIRIE AND SUISUN MARSH BOUNDARIES

DEPARTMENT OF WATER RESOURCES

FIG. 5-4

voles) prefer open areas, mammal diversity is increased where there is cover provided by shrubs, windbreaks, woodpiles, and so on. Domestic animals are also common in the area. Cattle and sheep are the principal livestock maintained on pasture lands. Horses are kept in a few locations, and dogs and cats are generally present around residences.

5.3.2.2 Fisheries

5.3.2.2.1 Lindsey Slough. Because Lindsey Slough was the site originally selected as the diversion point for the North Bay Aqueduct, the California Department of Fish and Game (DFG) periodically collected fish from the Slough between 1975-1979. A total of 25 species were collected, using otter trawls, seines, and gill nets. /38/ Fish were also collected from Lindsey Slough during 1979 by a private consultant. /29/ A total of 21 species were collected with a beach seine, 10 of which were not captured during the DFG surveys. While these surveys are useful in determining the type of fish likely to occur in Lindsey Slough, the results do not necessarily reflect abundance.

5.3.2.2.2 Striped bass (Morone saxatilis), an important introduced sport fish in the San Francisco Bay area, was a common species in the Lindsey Slough sampling. Most of the fish collected were young of the year. These larvae and juveniles were captured primarily during the months of June (1975, 1977, 1978) and August (1975). King (chinook) salmon (Oncorhynchus tshawytscha), which also supports a sport and commercial fishery in coastal waters and migrates into Delta waters, were occasionally present in Lindsey Slough. All of the specimens collected were relatively large (the smallest individual measured 54 cm).

5.3.2.2.3 Other anadromous fish collected in Lindsey Slough were steelhead and American shad. In addition to anadromous fish, freshwater gamefish, forage fish, and miscellaneous species were periodically collected in Lindsey Slough. The freshwater gamefish include white catfish, channel catfish, bluegill, white crappie, black crappie, and largemouth bass. These species were collected in Lindsey Slough in low numbers at various times of the year. Important forage species present in Lindsey Slough include threadfin shad, Delta smelt, and longfin smelt.

5.3.2.2.4 No fish collections have been made in either Cache Slough or Calhoun Cut. Since Calhoun Cut is an extension of Lindsey Slough, the species collected in Lindsey Slough may also be present in Calhoun Cut. Parts of Calhoun Cut have been extensively modified, reducing the habitat value and possibly reducing fish diversity. Much of Cache Slough has also been channelized, reducing the riparian vegetation along the dikes. The water quality in Cache Slough has deteriorated to a greater extent than in Lindsey due to urban runoff from Vacaville and irrigation drainage of surrounding agricultural lands. It is probable that fish abundance and diversity is lower in Cache Slough than in Lindsey Slough.

5.3.2.3 Threatened and Endangered Species

5.3.2.3.1 The distribution of the giant garter snake (Thamnophis couchi gigas), a candidate species for protection by the U. S. Fish and Wildlife Service, is not well known. This species is currently considered rare by the California Department of Fish and Game. Its range apparently extends from the vicinity of the Sacramento-San Joaquin Delta south through Kern County. The giant garter snake is considered to be aquatic confined to areas around permanent fresh water. /30/ It prefers areas of open water without extensive riparian vegetation. The giant garter snake has not been recorded from Lindsey or Cache

Sloughs; this area of the Delta is apparently west of its normal range. /31/ However, it is possible that the giant garter snake could occur within the project area.

5.3.2.3.2 The black rail (Laterallus jamaicensis) has been recently observed in freshwater marsh areas of Suisun Marsh. This species has been designated by both California Department of Fish and Game and the U. S. Fish and Wildlife Service as rare.

5.3.2.3.3 The salt marsh harvest mouse (Reithrodontomys raviventris halicoetes), designated by the U. S. Fish and Wildlife Service and California Department of Fish and Game as an endangered species, is known to occur in Suisun Marsh. This species is found only in salt marshes supporting a continuous stand of pickleweed (salicornia). One area of known habitat is along Cordelia Slough, south of the proposed alignments for Routes 2 through 7. Probable habitat for the salt marsh harvest mouse also occurs along Suisun Slough, south of the alignment for Routes 2-7, and around the tip of Denverton Slough, south of Route 7. /32/

5.3.2.3.4 The Delta green ground beetle (Elaphrus viridis) has been recently listed by the U. S. Fish and Wildlife Service as an endangered species. A critical habitat area for the beetle has also been defined and is generally located between Barker Slough and Calhoun Cut. This beetle is apparently restricted to the edges of two vernal pools in this area. The previous loss of vernal pools due to stream conversion of natural habitats to agricultural and urban use may have limited the range of the Delta green ground beetle. /33/ The northern proposed NBA alignment passes within half a mile of ground beetle habitat (see Appendix D).

5.4 AIR RESOURCES

5.4.1 CLIMATE

5.4.1.1 While pollutant emissions are fairly constant throughout the year, pollutant concentrations in the air fluctuate widely, depending on the weather. /34/ Air quality is affected by climatic conditions such as cloud covers, wind directions and speed, and temperature inversions. Strong regional winds, predominantly from the west and southwest, bring pollutants from the San Francisco Bay area to Solano County. /35/ Winds are strongest during the summer; in winter the winds are more variable. /36/

5.4.1.2 Meteorological conditions in southwestern Solano County are typical of the temperate San Francisco Bay area, with cool rainy winters and warm dry summers. The northeastern portion of the County has weather conditions characteristic of the Sacramento Valley, where marine influence is minimal, summers are hot and dry, and winter temperatures are often near the freezing point. Unobstructed sunlight, present in greater amounts during the dry summers, stimulates production of secondary pollutant oxidants.

5.4.2 AIR QUALITY - CURRENT TRENDS

5.4.2.1 The southwestern portion of Solano County lies within the San Francisco Bay Area Air Quality Management District (BAAQMD), and the northeastern portion of the County lies within the Yolo-Solano County Air Pollution Control District of the Sacramento Valley Air Basin. The Solano County portion of the BAAQMD is a nonattainment area (i.e., federal standards for these pollutants are not currently achieved) for carbon monoxide (CO) and oxidants. /37/ Carbon monoxide, a toxic gas, is a localized problem near busy streets and highways. Oxidants in Solano and Napa Counties primarily consist of ozone, an area-wide pollutant whose precursors are hydrocarbons and oxides of nitrogen. /38/

5.4.2.2 The portion of Solano County in the Sacramento Valley Air Basin is also a nonattainment area for CO, and oxidants, and in addition is a nonattainment area for suspended particulates (primarily due to dust and agricultural burnings). /39/ Sources of CO are similar to those in the Bay area. Oxidant levels appear to be

high as a result of wind transport of pollutants from the San Francisco Bay area. The oxidant standard was exceeded during the years where oxidant was measured in both Rio Vista and Fairfield. However, more recent years show a smaller number of standard excesses, which may be indicative of a general trend of lower ozone concentrations.

5.4.3 AIR QUALITY MANAGEMENT

5.4.3.1 Air quality plans for the Bay area and Sacramento Valley basins have been written by the Association of Bay Area Governments (ABAG) and the Sacramento Regional Area Planning Commission, respectively. In the Bay Area Basin, including Napa and Solano Counties, the emphasis is on attainment of the oxidant standard through further reduction of hydrocarbon emissions. With respect to hydrocarbons emission from mobile source, the Bay Area Air Quality Plan suggests pollution control equipment on new motor vehicles and on trucks currently in use, and periodic inspections of cars and trucks.

5.4.3.2 Additional NOx control measures are not planned at this time with the goal of leaving nitrogen oxides emissions at a relatively constant level over the next 20-25 years. /41/ Carbon monoxide control strategies in the Bay Area Basin involve reducing CO levels in motor vehicle-exhaust, improving traffic flow, and improving alternative transportation systems to the private automobile. The Sacramento Regional Area Air Quality Plan recommends a number of measures for pollutant emissions control in Solano County, including transportation improvements, motor vehicle inspection and maintenance programs, implementation of existing land use plans, and land use studies to determine the impacts of increased densities and to reorder local development priorities. /42/

5.4.4 FUTURE PROBLEMS AND CONSTRAINTS

Future housing and industrial development in Solano and Napa Counties will generally have an adverse effect on air quality and make it more difficult to meet and maintain air quality standards. A possible large future source of emissions in the project area vicinity which could have a major impact on air quality is the proposed Pacific Gas and Electric (PGandE) Power Plant at Collinsville. This plant would be expected to emit large amounts of sulphur dioxide, oxides of nitrogen, and carbon monoxide.

5.5 CULTURAL RESOURCES

5.5.1 ARCHAEOLOGICAL SITES

5.5.1.1 Numerous prehistoric archaeological sites are recorded throughout the central and southern Solano County region. The existing records tend to indicate that the greatest number of known archaeological sites are concentrated around major drainage systems in protected valleys which extend toward the sloughs, marshes, rivers and bays that characterize the southern end of Solano County. The records also imply that the immediate environs of the numerous intermittent creeks and drainages situated throughout the project are archaeologically sensitive.

5.5.1.2 Based on the known record, Green Valley, Suisun Valley, Lagoon Valley, and the Lindsey Slough-Calhoun Cut area have been identified as particularly sensitive regarding both the existence of known archaeological sites and the potential for encountering additional unrecorded sites. The archaeological sensitivity of these areas has been established by a number of early academic archaeological

investigations in Central Solano County as well as more recent EIR generated field investigations concentrated in those areas. /43, 44, 45, 46/ However, the majority of the terrain through which the alternative alignments would pass has not been subject to previous archaeological field investigations. Extensive archaeological work will be done on the route chosen for the North Bay Aqueduct.

5.5.2 HISTORICAL STRUCTURES AND FEATURES

5.5.2.1 Field surveys of selected alignments for the North Bay Aqueduct were performed in early August 1980. Routes 1, 4, and 6 in the project area were subjected to a surface field inspection, and the potential for encountering archaeological resources in the various sensitive locales was identified. The findings of this field survey are summarized in section 6.5 of this report and attached in Appendix E.

5.5.2.2 Numerous structures and features important to the history of Solano County are documented in the vicinity of the project area. /47, 48, 49/ However, a review of the record suggests that no known historic resources fall within any of the alignment alternatives. It is noted, however, that the Cement Hill Historic Resources are situated immediately north of Route 1. In addition, Cordelia Junction has numerous historically significant structures which are situated close to several alternative alignments including a small redwood barn (Ca. 1890) located in Green Valley, northwest of Cordelia Junction, and the Suisun-Fairfield Railroad Station (Ca. 1910) located in Suisun City.

5.6 POPULATION

5.6.1 The State Department of Finance has projected that Solano County will grow 23.2 percent in population between 1980 and 1985, to a total of approximately 270,000. The Association of Bay Area Governments' projection for the Solano County population in 1985 is in agreement with the Department of Finance figure of 268,000. By 1990 the population is expected to reach 326,000. Solano County is expected to experience the third largest gain in population for California counties which had 1980 populations of 100,000 or more.

5.6.2 The population of Solano County, approximately 223,000, is distributed in seven cities and scattered rural locations. /50/ The unincorporated area of the County contains only about 8 percent of the population. Development in the County is concentrated in three areas: the southwest (Vallejo-Benicia), north central (Vacaville), and the west central (Suisun City, Fairfield-Travis AFB). The Vallejo-Benicia area accounts for approximately 93,000 residents; the Vacaville area has a population of 44,000, and the remaining 66,000 residents occupy the urban areas and fringes of the central county (Suisun City, Fairfield-Travis AFB).

5.6.3 In central Solano County the bulk of the population is associated with the Suisun City-Fairfield complex. Between 1950 and 1975 the City of Fairfield increased twelve-fold in population (from 4,000 to 50,000). The annexation of the 7.5 square mile Travis AFB in 1966 contributed to the almost 200 percent increase in population between 1960 and 1970. Additionally, much of the growth in the 1960s was the result of immigration to the area due to relatively low housing costs and accessibility to Bay area employment.

5.6.4 The population within the Fairfield Sphere-of-Influence is expected to increase by 34 percent between 1980 and 1990. /51/ The population in the Sphere-of-Influence of Suisun City is projected to climb steadily, rising a total of 13
Fairfield-Travis area, is projected to

percent by 1990. The combined urban growth in these two areas may bring the total of central Solano County to over 92,000 by the year 2000.

5.6.5 The Green Valley area west and southwest of Fairfield may be expected to experience a great deal of growth due in part to its proximity to San Francisco Bay area transportation corridors. The Association of Bay Area Governments (ABAG) projects a 1985 population in this area of 6,498, a five-fold increase over the 1975 population. As many as 8,442 residents could be expected by 1990. However, the present Solano County General Plan designations in rural Green Valley would only allow development to accommodate 4,100 persons. /52/

5.6.6 The General Plan for Suisun City (1979) projects a population holding capacity of 21,000, revised downward from earlier estimates that ranged up to 30,000. The current commitments to development in Suisun City are expected to increase the population to at least 15,000 in the mid-1980s. /53/ The Fairfield General Plan projects a potential increase of 82,000 residents in its Sphere-of-Influence by the year 2000 (excluding population changes related specifically to Travis AFB). The low growth scenario estimates 113,750 residents by 2000, while with high growth the population could reach 162,950. /54/

5.6.7 The population of Napa County in 1979 was approximately 95,000, over half in the incorporated City of Napa, and the remainder distributed among the Cities of Calistoga, St. Helena, and Yountville, and unincorporated areas. /55/ Urbanization is concentrated in the southern County and around the City of Napa. In November 1980, Napa County voters approved a measure which would institute a growth management policy geared to a 1 percent annual growth rate. However, residential development controls in the City of Napa were recently rescinded.

5.7 LAND USE

5.7.1 LAND USE TRENDS

5.7.1.1 More than 90 percent of the land area of central Solano County is in agricultural use or is parks, marsh, or range land. Agricultural products include field crops, fruit and nut trees, corn, and tomatoes. The Suisun Marsh Resource Conservation District covers 55,000 acres in the southern county. A vast grassland occupies the area east of Travis AFB, known as Jepson Prairie (see Section 5.3.1). Approximately 10,000 acres of developed urban area exist in Suisun City and Fairfield-Travis. /56/

5.7.1.2 Most of the existing development in Suisun City has taken place in the confined area between Suisun Marsh and Fairfield's southern boundary (West Texas Street and the Southern Pacific right of way). In 1965 Suisun City's developed area covered approximately 130 acres. /57/ Subdivision development in recent years has converted the majority of land adjacent to Suisun City east of Marina Boulevard and north of State Route 12 to residential land use.

5.7.1.3 The Suisun City General Plan projects that by the mid-1980s the developed area will be 2,690 acres. The City is currently proceeding on actions to deannex large portions of those lands within its boundaries which are also in the Suisun Marsh. Residential development is forecast to provide about 6,600 new dwelling units and consume 1,460 acres of land by 1985. The Suisun City General Plan designates most residential development as low to medium density, with multi-family development limited to 40 percent of the total housing stock. Industrial and commercial uses will occupy over 900 acres according to the General Plan, which will nearly double the amount of land in commercial use. Large open-space preserves are planned

in the eastern part of the Suisun City Sphere-of-Influence, on the borders of Travis AFB. The direction of city expansion will be toward the northeast. Attainment of a population of 21,000 is based on the anticipated annexation and development of land east of Walters Road and south of East Tabor Avenue.

5.7.1.4 The City of Fairfield covered an area of 1,800 acres in 1965 with approximately 70 percent in residential use. /58/ The following year Travis AFB was annexed adding nearly 5,000 acres to the City's size. By 1975, the population was 50,497, and Fairfield-Travis had a developed area of about 8,000 acres. /59/ Fairfield's Sphere-of-Influence includes a southwestern corridor stretching along Highway I-80 to Cordelia, a small unincorporated population center. The Fairfield General Plan recommends that two urban growth centers be established in the planning area -- one including the existing Fairfield urban area and the other centered around Cordelia, where population is projected to reach 37,000 with a developed area of 4,500 acres. /60/ This contrasts with the present development which covers fewer than 100 acres.

5.7.1.5 Major growth in Fairfield is anticipated to be in two general areas: 1) southwest, absorbing the College, the south end of Green Valley, and some of the Cordelia area; and 2) along the northern city boundaries from the east side of Suisun Valley to Peabody Road. The total urbanized land area will be about 9,300 acres by 1985, including residential expansion on over 525 acres. Within the Fairfield Sphere-of-Influence approximately 9,000 acres of undeveloped land exists, much of it prime agricultural soil which will be developed by the year 2000, assuming implementation of the Fairfield General Plan. The land use element of the General Plan designates over half (5,500 acres) of the undeveloped land for residential development and the remainder for all types of commercial and industrial uses. Most of the residential development is planned to be low density (2.5 to 4.2 units per gross acre). Future development on prime agricultural land is also expected in Green Valley, Paradise Valley, Cordelia, and south of North Texas Street. However, prime agricultural soils in Suisun Valley and north and south of I-80 are designated for protection under Fairfield's General Plan.

5.7.1.6 Vallejo has a population of approximately 80,000 (in 1980) and has a developed area of about 13,000 acres (including development at Mare Island Naval Shipyard). The City is located with the Carquinez Strait to the south, the Napa River and marsh areas to the west, the county line and steep hills to the north, and the City of Benicia to the east. These factors will limit development to an ultimate population of about 130,000. Most of the area available for new development lies along the eastern periphery ofthe City from Carquinez Strait to I-80 on the north. Development through 1985 is expected to take place between Redwood and Tennessee Streets east of I-80, and in the Glen Cove area south of I-780. Residential development is projected to provide about 5,500 new dwelling units on 1,700 acres by 1985.

5.7.1.7 Benicia is a City of 15,000 (in 1980) with about 3,000 acres of urbanized area on the northern edge of Carquinez Strait. The development of Benicia is limited by physical constraints: Carquinez Strait to the south, Vallejo to the west, Suisun Marsh to the east, and steep terrain to the north. Most of the area available for new development lies north of I-780 toward Lake Herman Road. By 1985 residential development is forecast to consume 710 acres of land, and development from all land uses will increase the total urbanized land area to 4,400 acres.

5.7.1.8 Vacaville has a population of over 40,000 (in 1980) and a developed land area exceeding 5,200 acres. Due to its location in Vaca Valley and the absence of physical barriers to

development, the capacity of the City is several times its current size. Development through 1980 is expected to occur at Browns Valley, northwest into Vaca Valley, and in most open areas south of I-80 and west of Leisure Town Road. The total urbanized land area by 1985 is projected to be about 8,400 acres, with 2,100 acres designated for new residential development between 1975 and 1985.

5.7.1.9 In the unincorporated areas of Solano County that are not within the sphere-of-influence of existing cities, land uses are projected to remain largely agricultural and recreational. The small towns of Dixon and Rio Vista had a combined developed area of about 1,800 acres in 1975. Dixon is surrounded by land suitable for development, but it is prime agricultural land. Development through 1985 in Dixon is expected to occur primarily toward I-80 to the west and north, increasing urbanized land areas to about 1,800 acres by 1985 (compared to 1,000 acres in 1975). Rio Vista has virtually unlimited growth area toward the Montezuma Hills, and would most likely parallel State Route 12 westward toward Church Road. However, the rate of development is dependent upon the pace and extent of activities in the nearby Collinsville-Montezuma Hills industrial area. The rural sectors of East Solano County are projected to grow very slowly and land uses will remain primarily rural residential, agricultural and limited industrial.

5.8 PUBLIC SERVICES AND FACILITIES

5.8.1 POLICE AND FIRE PROTECTION

5.8.1.1 Police protection for the North Bay Aqueduct project area is provided by the Solano and Napa County Sheriff's Departments and Police Departments for the Cities of Fairfield, Vacaville, Suisun, Vallejo and Benicia in Solano County, and Napa and Calistoga Police Departments in Napa County. Police protection is considered adequate in Fairfield where the police department's funding is a percentage of the city budget and is therefore tied to the growth in the community. /61/ Benicia /62/ and Suisun City are also providing adequate service; however, Suisun City is at its service limit. /63/ The Vacaville Police Department considers itself understaffed due to the increased population of recent years. /64/ The City of Vallejo is faced with similar constraints and plans to cut back on services. /65/

5.8.1.2 The Solano County Sheriff's Department, responsible for police protection for unincorporated areas, is faced with similar service and budgetary constraints. The eastern sparsely populated areas of the County are identified as a problem area because of increased gas, tool, and farm and construction equipment thefts. With a shortage of personnel, response times to these calls have increased. /66/ The Napa County Sheriff's Department currently considers itself understaffed but it expects future consolidation to provide better service at considerable savings. /67/ The Napa Police Department is severely understaffed and has not been able to replace personnel. /68/ Calistoga Police Department, although adequate now, expects problems in keeping up with population growth in the near future. /69/

5.8.1.3 Fire protection for the project area is the responsibility of three city fire departments (Fairfield, Benicia, and Suisun City), and four fire districts in Solano County, two city departments (Napa and Calistoga), one district in Napa County, and the California Division of Forestry. Most departments and districts are feeling the pinch of reduced funding levels following passage of Proposition 13 and consider themselves understaffed. Isolated areas not incorporated into any organized fire protection district are served by the California Division of Forestry. The fire fighters are concerned about not being able to keep up

with growth and they expect to be forced to compromise on services during the next several years.

5.8.2 PUBLIC SCHOOLS

5.8.2.1 Several school districts in Solano County would likely be affected by population growth related to the availability of North Bay Aqueduct water. These districts, including the Benicia, Vallejo, Fairfield-Suisun and Vacaville Unified School Districts, have reported current enrollment figures at or close to capacity. Although all of these districts are in the process of either planning, acquiring, or constructing additional permanent school facilities, most rely on some sort of school impact fee imposed on new residential developments to provide temporary portable classrooms. In addition, a number of elementary schools in the Vallejo and Fairfield-Suisun Unified School Districts have switched to a year-round school term to meet the demands of a rapidly growing population.

5.8.2.2 In Napa County school districts, there are no school impact fees. The Calistoga Joint Unified School District is currently at capacity with enrollments increasing gradually. The Napa Valley Unified School District is the only district that is experiencing declining enrollments.

5.8.3 PARKS AND RECREATION

5.8.3.1 The Federal, State, County and local governments all provide recreational facilities in the project area. The Federal Government maintains a number of recreation facilities around Lake Berryessa. State parks include Brannan Island, Benicia Capital State Historic Park, and Benicia State Recreation Area in Solano County, and Bothe-Napa Valley State Park and Robert Louis Stevenson State Park in Napa County. The State Parks and Recreation Department has recently expressed an interest in establishing a portion of the Jepson Prairie in the project area as an ecological reserve. /70/

5.8.3.2 Local park departments in Solano County, with the exception of Vallejo, are facing problems of inadequate facilities because existing sites are underdeveloped and overused. The City of Fairfield is embarking on a program to develop its properties, including the long-planned linear park system along the abandoned Sacramento Northern Railroad right of way. /71/ Phase I of the system from the Solano Mall to the Community College is currently under construction. Suisun City is considering not building any new parks due to lack of operation and maintenance funds. /72/ The City of Vacaville has also decided not to build new parks until it has made firm arrangements for operation and maintenance funds. /73/ Although the City of Vallejo is well served by park and recreation facilities, it is reevaluating its ability to operate and maintain them. /74/ Local park and recreation facilities in Napa County, provided by Napa City, Calistoga, Yountville, and the American Canyon Water District, are feeling the general reduction in funding levels.

5.8.4 WATER SUPPLY*

5.8.4.1 The City of Vallejo receives water from the Solano Project (Lake Berryessa), its Cache Slough Diversion and, when necessary, from its Lake Curry system. The Vallejo Water District serves the City, Travis AFB, Green Valley Country Club, Rockville, and Cordelia. The Travis Treatment Plant only treats Delta water while Vallejo's two other

*This section briefly describes current sources of municipal and industrial water and water treatment facilities for jurisdiction within the proposed North Bay Aqueduct service area. For additional information see Chapter 3.0, Water Needs and Alternatives.

water treatment plants, at Lake Curry and Green Valley, treat a blend of Berryessa and Delta water. The District has experienced siltation problems with its Cache Slough intake, and maintenance dredging is periodically required. /75/

5.8.4.2 The Benicia Water District receives water primarily from the Solano Project supplemented by emergency supplies from Lake Herman. Operators of the City's treatment plant, which is now operating close to capacity, have expressed concern over the impact the Delta water quality (i.e., chlorides, TDS, organic chemicals) could have on their treatment system and the overall quality of their drinking supply. /76/

5.8.4.3 Water for the Fairfield Water Division also comes primarily from the Solano Project with a minimal amount from Vallejo's Lake Curry system. It has two water treatment plants, Dickson Hill, operating at about half capacity; and the Waterman plant on the Putah South Canal, which could easily be expanded to twice its current capacity. Since the Dickson Hill Water Treatment Plant does not have adequate facilities for treating high turbidity water, any North Bay Aqueduct supply would probably be treated at the Waterman Plant. /77/

5.8.4.4 Two-thirds of Suisun City's water supply comes from the Solano Project with the rest derived from local wells. Only Solano Project water receives treatment at the City's two filter plants: Mat Hill and Gregory Hill. City water officials are concerned about North Bay Aqueduct water quality. /78/

5.8.4.5 Local wells supply the majority of drinking water to the City of Vacaville year-round, while Solano Project water is only available during the summer. Vacaville has made a recommendation for a new treatment plant, including provisions for settling ponds to treat high-turbidity North Bay Aqueduct water, if necessary. Vacaville's main concerns about the North Bay Aqueduct are with the quality and quantity of water available as well as the cost incurred to pump it into its system. /79/

5.8.4.6 The Napa City Water Department receives water from Lake Hennessey, Milliken Reservoir and temporary water from the Solano Project through the existing Phase I North Bay Aqueduct facilities. The Jameson Canyon Treatment Plant, which would treat North Bay Aqueduct water, occasionally exceeds its rated capacity by as much as 25 percent. /80/ The American Canyon Water District, currently receiving water from the Solano Project, is particularly concerned about the impact of North Bay Aqueduct water on its treatment system. The District has an agreement to receive Aqueduct water from the City of Napa in water supply emergencies. /81/ The Cities of Yountville and Calistoga are finalizing agreements with the Napa County Flood Control and Water Conservation District to receive North Bay Aqueduct allocations. /82/

5.8.5 SANITARY SERVICE

5.8.5.1 Sanitary service in Napa and Solano Counties is provided by a number of sanitary districts and city public works departments. Those covering the North Bay Aqueduct service area include the Fairfield-Suisun Sewer District, Vacaville Sanitary Service, Vallejo Sanitation and Flood Control District, and Benicia Public Works in Solano County, and American Canyon Water District and City services for Napa, Calistoga, and Yountville in Napa County.

5.8.5.2 The Fairfield-Suisun Sewer District provides advanced waste water treatment at its treatment plant currently operating at 9.5-10 mgd. Facilities are being developed to increase the design capacity from 10.35 to 15.7 mgd and to improve treatment by mid-1981. The Solano Irrigation District and duck clubs in Suisun Marsh currently use

reclaimed water from the plant. When construction is completed, there are plans to increase the use of reclaimed water to 12 mgd. The District is investigating the beneficial application of reclaimed water to the Marsh, and the Department of Water Resources is considering plans to flush Cordelia Slough with reclaimed water. /83/

5.8.5.3 The Easterly treatment plant in Vacaville provides secondary waste water treatment before discharging into Alamo Creek, a tributary to Cache Slough. The Vacaville Sanitary Service is updating the Easterly plant to increase its capacity slightly. Vacaville has been investigating alternatives to its present treatment and discharge system, including improving existing treatment to a tertiary level and/or relocating its existing discharge to Barker Slough, a tributary of Lindsey Slough. /84/

5.8.6 UTILITIES*

Numerous major utilities and other quasi-public or private concerns have transmission corridors through the project area and could be affected by construction of the North Bay Aqueduct. Pacific Gas and Electric Company (PGandE) has underground gas mains ranging in diameter 8 inches to 36 inches at depths of 3 to 7 feet. It also maintains overhead electrical transmission lines that cross most of the proposed aqueduct routes. /85/ Shell Oil Company maintains and operates a 10-inch gas pipeline approximately 2 to 3 feet below ground surface that would be crossed by the North Bay Aqueduct. /86/ The U. S. Department of Energy has its Shasta-Tracy and Cottonwood-Tracy double-circuit transmission lines, an integral part of the Federal Central Valley Water Project, located in the vicinity of the project area. /87/ Pacific Telephone has numerous facilities within the project area. Fairfield has requested they bury their lines along the Sacramento Northern Railroad right of way when the city's linear park is constructed. The telephone company has crossings at every major intersection in Fairfield and has identified the area north of Highway 12 and east of Fairfield as being the highest impact area. /88/

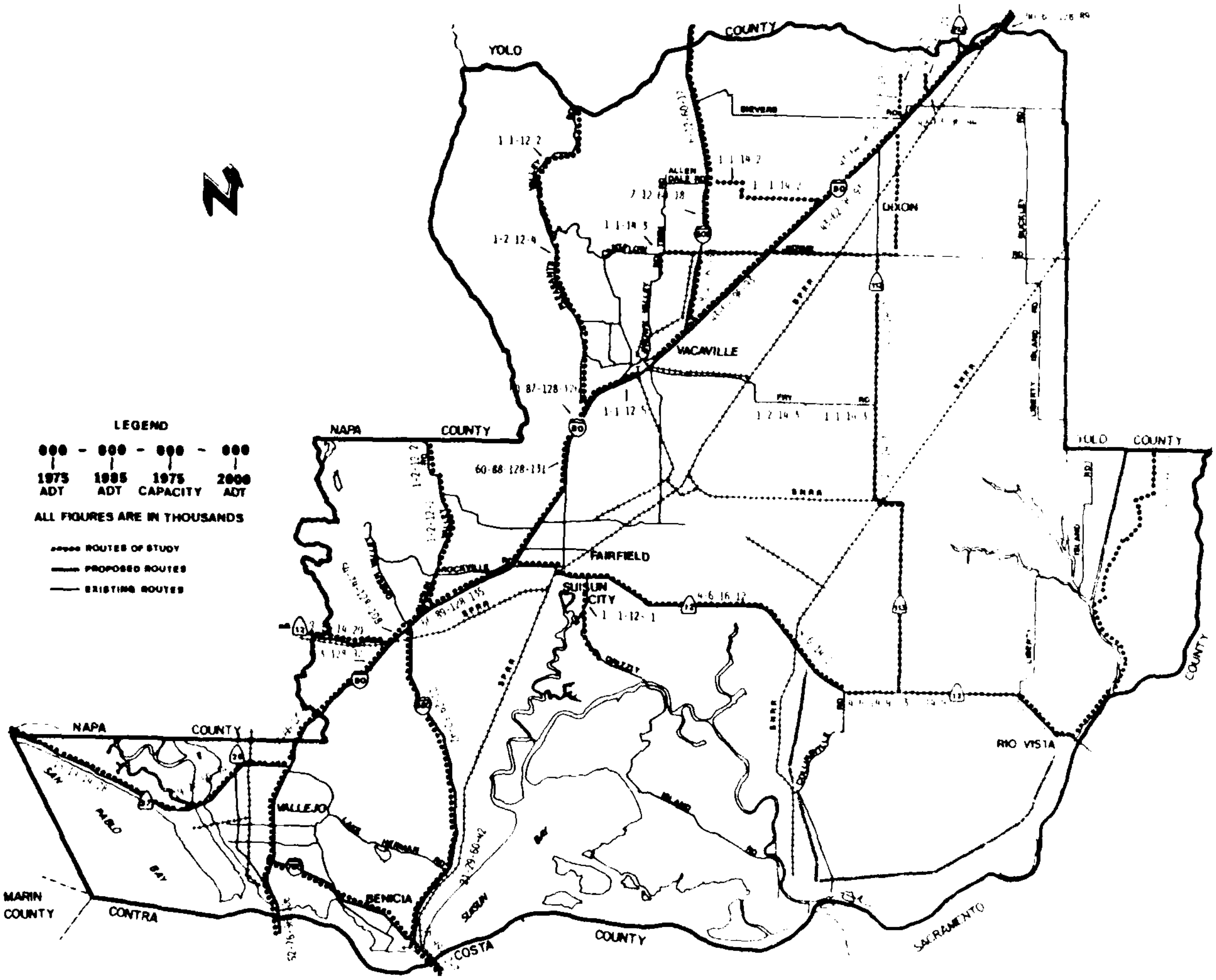
5.9 TRAFFIC AND CIRCULATION

5.9.1 AUTOMOBILE AND TRUCK TRANSPORTATION

5.9.1.1 Solano County is served by major highway routes because of its location between the San Francisco Bay Area and the Sacramento Valley. These include Interstate 80 connecting San Francisco, the East Bay, Sacramento and eastern California; Interstate 680, connecting Interstate 80 near Fairfield and Contra Costa and Santa Clara Counties, and Interstate 505, providing a direct link between Interstate 80 and Interstate 5 to the north. State Route 113 is the major county north-south route; State Highway 12 is a major east-west corridor. Intracounty routes include Elmira Road, Jepson Road, and Fry Road near Vacaville; Air Base Parkway, West Texas Street, and North Texas Street, Rockville Road and Travis Road in the Fairfield-Suisun City area, and Pleasant Valley Road and Suisun Valley Road in the western portion of the county. /89/

5.9.1.2 Average daily traffic (ADT) on major Solano County roads measured in 1975, and projections for 1985 and 2000, are presented in Figure 5-5. Caltrans data indicate that peak hour traffic in Solano County (1978 figures) is about 270 on Route 113, ranges from 650 to 2,450 on the various sections of Route 12, and from 7,400 to 9,500 on Route 80. /90/ The current routing of Highway 12 along West Texas Street has resulted in heavy traffic, especially truck traffic,

*For specific locations of major facilities and utilities, refer to segment maps 1-11 (Figures 6-1 through 6-11). Due to the extensive research and field work required to do detailed, specific sitings, the maps represent approximate sitings.



Source: Solano County Transportation Plan, February 1979

AVERAGE DAILY TRAFFIC IN SOLANO CO. - 1975, 1985, and 2000

FIG. 5-5

along this street. The Fairfield Bypass, under construction, is designed to eliminate the heavy traffic on West Texas Street. /91/

5.9.1.3 Within Fairfield, the major arterials run in east-west and north-south directions. The major local thoroughfares in Fairfield are Air Base Parkway, Travis Boulevard, North Texas Street and West Texas Street. State Route 12 coincides with West Texas Street, thus passing through downtown Fairfield. /92/ A major deficiency in the Fairfield street system is an inadequate number of roadways oriented in an east-west direction. A few roads cross Interstate 80, and few continuous east-west roads are located east of this interstate. According to the Fairfield General Plan, the greatest deficiency in east-west traffic routes exists between Pennsylvania Avenue and North Texas Street and in areas north of Travis Boulevard. /93/ Insufficient capacity is also a problem at two Interstate 80 interchanges in the Fairfield area: the Travis Boulevard and Air Base Parkway interchanges. The Texas Street-Pennsylvania Avenue and Travis Boulevard-Texas Street intersections are approaching capacity. /94/ Street and highway projects are planned for Solano County through 1985. /95/ These projects, designed to correct safety deficiencies and to provide needed capacity increases, are part of the Short Range Element of the Solano County Transportation Plan. The Long Range Element describes potential problems and solutions for transportation to the year 2000.

5.9.2 RAILROAD TRANSPORTATION

5.9.2.1 Two railways cross portions of Solano County the Sacramento Northern Railroad and the Southern Pacific Railroad. These railways are shown in Figure 4-1. An average of less than one Southern Pacific train per week runs from the junction near Canon Road to Vacaville. Other sections of Sacramento Northern track are used only occasionally. The California Railway Museum has its own track at Rio Vista Junction operating every weekend. /96/ If the PGandE-Collinsville power plant were completed, approximately two trains per day would run on the Sacramento Northern tracks from the Southern Pacific-Sacramento Northern junction near Canon Road to the point where the Northern track meets Highway 113, and then south to Collinsville.

5.9.2.2 The Southern Pacific track is used for both freight trains and Amtrak trains. Southern Pacific runs approximately 20 freight trains per day between Martinez and Sacramento. /97/ Additionally, about five freights per day run between Fairfield and Cordelia on a Southern Pacific branch line. Amtrak runs two passenger trains per day through Fairfield on the Martinez-Sacramento line, two in each direction. /98/

5.10 PUBLIC HEALTH AND SAFETY

Neither the State nor Solano County Department of Public Health has any local regulations or policies regarding open aqueducts as water-conveyance systems. To determine the potential risk of open aqueducts to public safety, it is useful to examine the experiences of other aqueducts in the State. Table 5-2 lists the records of drownings in some of these systems. There does not appear to be any pattern of drownings with regard to location, age, or sex. The velocity of water in the aqueduct is considered an important factor in the drownings. Several of the incidents were attributed to drunkenness or suicide. /99/

TABLE 5-2

RECORD OF DROWNINGS IN CALIFORNIA OPEN AQUEDUCTS

Aqueduct	Fences	Years of Record	Drownings	Length Miles Approx.	Remarks
Putah South Canal	chain link wire mesh	19[illegible]-80 (14)	16	34	Some attributed to drunkness or suicide. Rural location - some urban.
Contra Costa Canal	not entirely fenced	[illegible]-79 ([illegible])	50	42	Rural - urban location.
California Aqueduct	--	[illegible] (12)	60	400	Rural location. Access provided and encouraged. Road along berm.
South Bay Aqueduct	chain link barbed wire	1964-80 (16)	0	13	Well fenced. Rural location. No access.
Folsom South Canal	chain link	[illegible] ([illegible])	2	22	Some access - rural location.
Tehama Colusa Canal	chain link wire mesh barbed wire	1973-[illegible] (7)	[illegible]	[illegible]	Rural location.
Delta Mendota Canal	wire mesh barbed wire	1951-[illegible] (29)	71	[illegible]	Some attributed to suicide. Rural location.
Friant Kern Canal	chain link wire mesh barbed wire	1950-75 (25)	59	[illegible]	Some attributed to suicide or murder. Rural location.
Proposed North Bay Aqueduct	chain link barbed wire	--	--	[illegible]	[illegible]

5.11 ENERGY

5.11.1 Electrical energy is the principal form of energy considered here. In addition to electricity for pumping, other "end uses" of energy, such as diesel fuel for transportation, are considered.

5.11.2 Energy use* per capita in the State is outlined in Table 5-3. The transportation, industrial, and residential sector represent 49, 21, and 16 percent of the energy economy, respectively. Natural gas and gasoline account for 26 and 29 percent of the end uses of energy, and 11 percent is used as electricity. Electrical power is generated in

*Electrical energy is measured in kilowatt hours (Kwh). The energy content of fossil fuels, or of other fuels which are principally converted to energy by combustion, is measured in British thermal units (Btu). A Btu is the amount of heat needed to increase the temperature of one pound of water by one degree Fahrenheit. The energy value of electricity can also be expressed in Btu; the conversion factor used here (9,700 Btu/Kwh) reflects the thermal content of the fuel (coal, oil, nuclear) required to generate and distribute electricity. The use of this factor reflects the extent to which new end uses of electricity deplete basic resources.

TABLE 5-3

ANNUAL STATE ENERGY
USE PER CAPITA*

Economic Sector California	Electricity	Natural Gas	Gasoline	Other	Total	
Residential	8	27	0	3	38	(16)
Commercial	9	10	0	2	21	(9)
Industrial	6	23	0	20**	49	(21)
Agricultural	1.7	0.2	1.4	0.9	4	(2)
Transportation	--	0	65	47#	112	(49)
Other***	--	--	--	--	7	(3)
	25	60	67	73	231	100%

State Water Project## (1980 Water Year)	
Hydroelectric generation	1.3
Pumping power use	1.5
Net Power Use:	0.2

* Assumes 22 million population, in million Btu/capita.

** Principally consists of still gas, distillates, coal, residual oil, and biomass.

*** Non-fuel petroleum products.

\# Principally consists of aviation fuel, distillates, and residual oil.

\## Hydroelectric generation was about 2,856 million kilowatt hours and pumping power use was about 3,354 million kilowatt hours. 1980 is considered a typical year for hydroelectric generation.

SOURCES: Office of Planning and Research/Department of Water Resources, 1978, California Water Atlas; California Energy Commission, 1979, Energy Choices for California: Looking Ahead. Introduction to the 1979 Biennial Report.

California from petroleum (46 percent), natural gas (26 percent), coal (10 percent), and nuclear, geothermal, or hydropower (18 percent). /100/

5.11.3 Approximately 2,238 million kwh of electricity were generated by the Edward Hyatt and Thermalito power plants during 1980 and were sold to three California electric utilities. Hyatt-Thermalito generation occurs primarily during periods of maximum loads (on-peak periods). The State Water Project pumping plant energy requirement during 1980 was about 3,354 million kwh, which was met by 618 million kwh from SWP recovery plants and 2,736 million kwh purchased from electric utilities. The purchased energy was mainly obtained from the utilities during periods of low loads (off-peak periods).

5.11.4 Municipal and industrial water use produces waste water which must be treated before it can be released. Energy use typical of activated sludge treatment and tertiary treatment of municipal wastes are presented in Table 5-4. Plant operations for both states of treatment are energy-intensive, and the dollar cost of total energy expenditures -- direct and indirect -- is greater tha 25 percent of all operating costs. /102/

5.11.5 Agricultural use of water for irrigation is also energy-intensive. This is particularly true for nonlevel lands where the water must be pumped through sprinkler systems. Runoff from irrigation is a small fraction of the applied water and is not treated as waste water. In contrast, most of the water used by cities or industries becomes waste water which must be treated. Table 5-4 compares energy cost of irrigation with the energy cost of waste water treatment. Agricultural, municipal, and industrial use of water incur similar energy costs upon discharge into the environment.

5.11.6 About 90 percent of the water supply of Solano County is used for agriculture, and the remaining 10 percent for municipal and industrial use. About one-fourth of the supply is ground water which must be pumped from wells. In Napa County, the supply to municipal and industrial users is about 65 percent of the total water supply and consists almost entirely of surface water. Agricultural water, about 35 percent of the total supply, is almost entirely ground water.

5.12 NOISE /103/

5.12.1 High noise levels exist in a number of areas in Solano County. Community Noise Equivalent Levels (CNELs) represent the average of all sound level reached during a 24-hour day, with average figures adjusted to an equivalent level that accounts for the greater annoyance caused by nighttime noise.

The densely developed urban areas in Solano County may have CNELs about 65 dBA* (approximately the noise level of a vacuum cleaner at 10 feet), while quieter rural areas typically have CNELs in the range of 45 dBA.

5.12.2 On a county-wide basis, noisy corridors generally follow highway and active railway routes and aircraft take-off and landing patterns. Vehicular traffic is a major producer of both day and nighttime noise in most areas of the county. Along highways, peak noise levels are produced by truck traffic. Noise levels are high along U. S. Interstate Highway Routes 80, 505, 680, 141, and 220. For these highway routes, CNELs are 65 to 70 dBA on the road itself. Along smaller State routes such as Highway 113, CNELs drop to 50 dBA within approximately 500 feet of the road. However, along the more heavily traveled

*dBA: decibels measured on the A-weighted scale which is sensitive to the frequency response of the typical human ear at commonly encountered noise levels.

TABLE 5-4

SECONDARY WATER-RELATED ENERGY USE

Use	Electricity (Kwh/acre-ft.)		Electricity (million Btu/acre-ft.)	Natural Gas (million Btu/acre-ft.)	Chemicals (million Btu/acre-ft.)
Municipal Wastewater Treatment					
Activated Sludge	290		2.8	1.1	0.3
Tertiary Treatment	370		3.6	--	2.8
Total:	660		6.4	1.1	3.1
Irrigation					
Groundwater pumping (from 100' to surface)	170	or	1.7		*
Sprinkler System Total:	350		3.4		

*Significant energy consumption is associated with the use of fertilizer, pesticides, and gasoline (see Table 5-2).

SOURCES: Davidson et al. 1976. Energy Needs for Pollution Control. In Robert H. Williams (ed.) Energy Conservation Pepers. Ballinger Publishing, Cambridge, Mass.

Robertson, E. and Hagan, R. 1979. Energy Impacts of Alternatives for Water Conservation in Irrigated Agriculture. In Rocco A. Favvolare and Craig B. Smith (eds.) Changing Energy Use Futures, Vol. IV.

routes such as I-80, CNELs do not drop below 50 dBA for a distance of approximately 5,000 feet from the roadway.

5.12.3 Noise levels are high along active railway lines, especially in areas where these lines parallel nearby highways. The CNELs near active railway lines are similar to those described above for interstate highways. Aviation activity at Travis AFB is also a principal noise source in Solano County. Noise levels in affected areas are as high as 80 dBA. The affected area includes the Base itself and areas south of Fairfield to Grizzly Bay.

5.12.4 The General Plans of Solano County, Fairfield, and Suisun City have policies regarding maximum allowble noise from construction equipment. Since construction activities are temporary and difficult to avoid, the noise standards are lenient relative to those for long-term sources of noise.

5.13 VISUAL AESTHETICS

As previously discussed, there is a great contrast between the eastern and western sections of the North Bay Aqueduct alignments. Visually, although the terrain is essentially level throughout the project area, the eastern portion is characterized by few trees and unrestricted open views. The view of the western portion of the project site reveals urban development and the associated transportation and utility corridors (see Plates 1 through 10).

REFERENCES CITED:

/1/ Ford, Robert S. 1979. Geologic Appraisal of Vernal Pools - North Bay Aqueduct.

/2/ This section is derived from Thomasson, H. G., Jr., Olmsted, F. H., and LeRoux, E. F., 1960; Geology, Water Resources and Usable Ground Water Storage Capacity of Part of Solano County, California; U. S. Geological Survey Water Supply Paper 1464, 1960; and U. S. Department of Interior and Bureau of Reclamation, Solano County Water Project-California, September 1979; A Report on the Feasibility of Water Supply Development, Preliminary Draft. September 1979.

/3/ Most of the material in this section was derived from the U. S. Department of Agriculture, Soil Conservation Service, 1977, Soil Survey of Solano County, California.

/4/ U. S. Department of Agriculture, Soil Conservation Service. 1973. Land-Capability Classification, Agriculture Handbook No. 210.

/5/ City of Fairfield. 1979. City of Fairfield General Plan, Environmental Assessment, Environmental Impact Report; Borcherdt. 1974. Studies for the Seismic Zonation of the San Francisco Bay Region, U. S. Geological Survey Professional Paper, 141-A.

/6/ Ibid.

/7/ Ibid.

/8/ Sims, et al. 1973. Preliminary Geologic Map of Solano County and Parks of Napa, Contra Costa, Marin and Yolo Counties, California, U. S. Geological Survey Miscellaneous Field Studies Map MF-484.

/9/ Sedway/Cooke. 1976. General Plan Revision Program, Health and Safety. Prepared for County of Solano and the Cities of Fairfield, Vacaville, and Suisun City.

/10/ Personal communication. Buck, Harold. Pacific Gas and Electric Company (Rio Vista Substation). August 1980.

/11/ San Francisco Bay Conservation and Development Commission. 1969. San Francisco Bay Plan.

/12/ Personal communication. Whisman, Ed. Department of Water Resources, Central District. December 1979.

/13/ Ford, Robert. 1979. Op. cit.

/14/ Personal communication. Plitt, Charles, Water Resources Manager. Solano County Department of Public Works, Fairfield. February 1980.

/15/ U. S. Department of Housing and Urban Development, Flood Insurance Administration, Flood Hazard Boundary Map, Solano County, California, Unincorporated area. 1978.

/16/ Personal communication. Lenaburg, Ray, Assistant Director for Engineering Services. Federal Emergency Management Agency, Division of Insurance and Mitigation, San Francisco. January 1980.

/17/ Department of Water Resources. 1967. Delta-Suisun Bay Pollution Investigation, Bulletin 123.

/18/ Personal communication. Folland, Erwin. City of Vallejo Water Department. June 1980.

/19/ Information in this section is taken from Solano County and U. S. Department of the Interior, Bureau of Reclamation, 1979; Solano County Water Project-California - A Report on the Feasibility of Water Supply Development, and Thomasson, H. G., Jr., Olmsted, F. H., and LeRoux, E. F., 1960; Geology, Water Resources and Usable Ground Water Storage Capacity of Part of Solano County, California, U. S. Geological Survey Water Supply Paper 1464.

/20/ U. S. Department of the Interior, Bureau of Reclamation, Mid-Pacific Region. 1979. Four Counties Study, Water Management Opportunities for Lake, Napa, Solano, and Yolo Counties, California.

/21/ Barbour, M. G., and Major, J. 1977. Terrestrial Vegetation of California. John Wiley & Sons. New York. p. 515-533.

/22/ Jain, S. (ed.). 1976. Vernal Pools - Their Ecology and Conservation. Institute of Ecology Publication No. 9. University of California, Davis. 93 p.

/23/ Holland, R. F., and Griggs, F. T. 1976. A Unique Habitat - California's Vernal Pools. Fremontia 4(3):3-6.

/24/ Griggs, F. T., and Whitlow, T. H. July 1979. A Floristic and Vegetation Survey of the Proposed North Bay Aqueduct. Prepare for Department of Water Resources.

/25/ Jones & Stokes Associates and EDAW. December 1975. Fish and Wildlife Element - Suisun Marsh Protection Plan. Prepared for California Department of Fish and Game.

/26/ Madrone Associates and Jones, B. E. March 1980. Sacramento-San Joaquin Delta Habitat Protection and Restoration Plan (Draft). Prepared for California Department of Fish and Game and U. S. Fish and Wildlife Service.

/27/ Ibid.

/28/ Personal communication. Odenweller, Dan. Bay-Delta Fishery Project, California Department of Fish and Game. January 7, 1980.

/29/ Personal communication. Wang, Johnson. Ecological Analysts, Inc.. February 11, 1980.

/30/ Jones and Stokes Associates and EDAW. December 1975. [illegible]

/31/ Personal Communication. Brode, John. Inland Fisheries, California Department of Fish and Game. March 18, 1980.

/32/ Jones & Stokes Associates, Harvey & Stanley Associates, and John Blayney Associates. August 1979. Protection and Restoration of San Francisco Bay Fish and Wildlife Habitat. Prepared for U. S. Fish and Wildlife Service and California Department of Fish and Game.

/33/ Federal Register. August 1978. Volume 43, No. 155.

/34/ Bay Area Air Pollution Control District. December 1973. Air Pollution and the San Francisco Bay Area. Eighth edition.

/35/ Solano County Transportation Council. February 1979. Solano County Transportation Plan, Final Environmental Impact Report.

/36/ Ibid.

/37/ Association of Bay Area Governments, Bay Area Air Quality Management District and Metropolitan Transportation Commission. 1979. Bay Area Air Quality Plan, San Francisco Bay Area.

/38/ Ibid.

/39/ Sacramento Regional Area Planning Commission. October 1978. Draft Air Quality Plan.

/40/ Association of Bay Area Governments, et al. 1979. Op. cit.

/41/ Ibid.

/42/ Sacramento Regional Area Planning Commission. October 1978. Op. cit.

/43/ Treganza, A. E., and Cook, S. F. 1948. The Quantitative Investigation of Aboriginal Sites: Complete Excavation with Physical and Archaeological Analysis of a Single Mound. American Antiquity 13(4): 287-297.

/44/ Greengo, R. E., and Arnett, A. A. n.d. Analysis of Artifacts from Peterson 2 (4-Sol-2), University of California Archaeological Survey Manuscripts, No. 105. Berkeley.

/45/ Personal communication. Weyand, Helen. January 1980.

/46/ McGonagle, Robert L. 1948. A Report on the Excavation of Peterson No. 1, Solano County. University of California Archaeological Survey Manuscripts, No. 8. Berkeley.

/47/ Department of the Interior, National Park Service. February 1978. National Register of Historic Places, Federal Register, 43:26.

/48/ Department of Parks and Recreation, State of California. 1976. California Inventory of Historic Resources.

/49/ Solano County Planning Department, Central Solano County Cultural Heritage Commission. 1977. Our Lasting Heritage: An Historic and Archaeological Preservation Plan for Central Solano County.

/50/ Association of Bay Area Governments. 1979. Projections 79.

/51/ Ibid.

/52/ Munk, [illegible] E., Solano County Planning Director, letter to Stan Hoffman, Association of Bay Area Governments. June 6, 1979.

/53/ Suisun City. 1979. General Plan.

/54/ City of Fairfield. 1979. General Plan.

/55/ Napa County Conservation, Development and Planning Department. October 1979. Population update.

/56/ U. S. Department of the Interior, Bureau of Reclamation. 1979. Four Counties Study, Water Management Opportunities.

/57/ Solano County. 1979. Environmental Impact Report on the Solano County Transportation Plan.

/58/ Simpson, et al. 1967. Fairfield-Suisun City and Green Valley-Cordelia General Plan.

/59/ Solano County. 1979. Op. cit.

/60/ Fairfield Department of Environmental Affairs. 1979. [illegible] the General Plan.

/61/ Personal communication. Paul, Wayne (Captain). Fair[illegible] Department of Public Safety. March 1980.

/62/ Personal communication. Bidou, Pierre. Ben[illegible] Department [illegible] 1980.

/63/ Personal communication. West (Chief). Suisun Police [illegible] 1980.

/64/ Personal communication. Tatum, Gary. Vacaville P[illegible] Ma[illegible] 1980.

/65/ Personal communication. Dart, Roland (Chief). [illegible] March 1980.

/66/ Personal communication. Cardoza (Sheriff). Sola[illegible] Department. April 1980.

/67/ Personal communication. Stewart, Phillip (She[illegible] Sheriff's Department. March 1980.

/68/ Personal communication. [illegible] (Captain). Napa [illegible] 1980.

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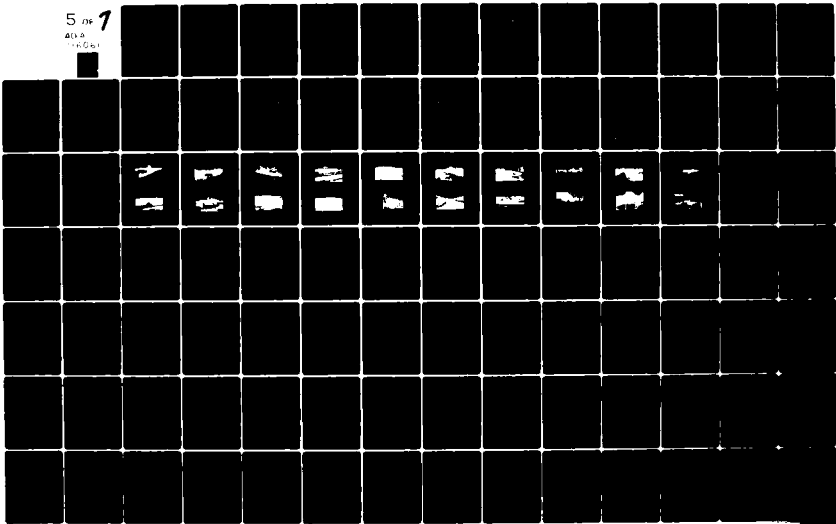

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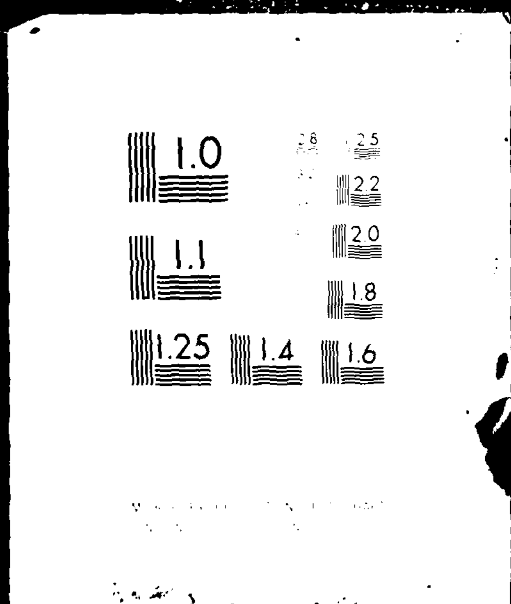


/69/ Personal communication. Autry, James (Chief). Calistoga Police Department. March 1980.

/70/ Personal communication. Meyer, Fredrick. California Parks and Recreation Department. March 1980.

/71/ Personal communication. Johnson, Ed. Fairfield Parks and Recreation Department. March 1980.

/72/ Personal communication. Gepp, Sam. Suisun Parks and Recreation Department. March 1980.

/73/ Personal communication. Nikalis, Ron. Vacaville Parks and Recreation Department. March 1980.

/74/ Personal communication. Turner, Maxine. Vallejo Parks and Recretion Department. March 1980.

/75/ Personal communication. Folland, Erwin. City of Vallejo Water Department. February 1980.

/76/ Personal communication. Winfield, Chester. Benicia Water Department. February 1980.

/77/ Personal communication. Beck, Charles, Water Superintendent. Fairfield Water Division. March 1980.

/78/ Personal communication. Roberts, Mr. Suisun City Water Department. March 1980.

/79/ Personal communication. MacLachlan, Norman. Vacaville Water Department, and letter from Jan-Marie Whitley, Administrative Civil Engineer Assistant, Vacaville Water Department, to Madrone Associates. April 9, 1980.

/80/ Madrone Associates. 1978. Final Environmental Impact Report, Hennessey Water Treatment Plant. Prepared for the City of Napa.

/81/ Personal communication. Schmoldt, Gunter, Manager. American Canyon Water District. February 1980.

/82/ Personal communication. Johanson, Ken. Napa County Flood Control and Water Conservation District. May 1980.

/83/ Personal communication. Tsugita, Ron. Fairfield-Suisun Sewer District. March 1980.

/84/ Personal communication. MacLachlan, Norman. Vacaville Sanitary Service. March 1980.

/85/ Letter from Hornoff, E. C., Division Land Supervisor. Pacific Gas and Electric Company to Madrone Associates. March 13, 1980.

/86/ Letter from Kerick, R. D. Products Organization/Operations/Pipelines, West Coast Division, Shell Oil Company to Madrone Associates. April 2, 1980.

/87/ Letter from Anderson, John D., Assistant Area Manager for Engineering. U. S. Department of Energy to Madrone Associates. April 17, 1980.

/88/ Personal communication. Orcher, John. Pacific Telephone. March 1980.

/89/ Transportation Council of Solano County. February 1979. Solano County Transportation Plan.

/90/ CalTrans. 1978. Traffic Volumes on California State Highways.

/91/ Fairfield Department of Environmental Affairs. January 1979. Draft Transportation and Circulation Element of the Fairfield General Plan.

/92/ Fairfield Department of Environmental Affairs. January 1979. Op. cit.

/93/ Ibid.

/94/ Ibid.

/95/ Transportation Council of Solano County. February 1979. Op. cit.

/96/ Personal communication. Ford, Glenn. California Railway Museum Committee. June 1980.

/97/ Personal communication. Dorman, Tom, Office Engineer. Western Area, Southern Pacific Railroad. November 1979 and January 1980.

/98/ Personal communication. Jones, Vicky. AMTRAK. February 1980.

/99/ Personal communication. Whisman, Ed. Department of Water Resources, Central District. March 1980.

/100/ California Energy Commission. 1979. Energy Futures for California: Two Scenarios 1978-2000.

/101/ Office of Planning and Research Department of Water Resources. 1978. California Water Atlas.

/102/ Davidson, et al. 1976. Energy Needs for Pollution Control. In Robert H. Williams (ed.) Energy Conservation Papers. Ballinger Publishing, Cambridge, Mass.

/103/ This section was largely derived from Sedway/Cooke, 1977, Health and Safety Element-Seismic Safety, Safety, Noise, A Part of the Solano County General Plan.

6.0 ENVIRONMENTAL ANALYSIS OF ALTERNATIVE AQUEDUCT ALIGNMENTS

6.0.1 There are three general levels of analysis in the environmental review of the proposed action to construct the Phase II facilities of the North Bay Aqueduct addressed in this chapter. The first level of analysis is concerned with the primary or direct environmental consequences of the proposed action; in this case, the construction and operation of aqueduct facilities along alternative alignments through Solano County. As many impacts typically associated with constructing and operating water transport facilities are relatively minor, of short duration, and/or largely controllable by some standard construction measures, the focus of Section 6.1 will be on those impacts which would be relatively significant or characteristic of a particular alignment. To complement this evaluation and reduce the length of discussion, segment maps (Figures 6-1 through 6-12) and photographic plates (Plates 1 through 10) are included on the following pages to illustrate site-specific environmental information along the proposed aqueduct alignment corridors.

6.0.2 The second level of analysis involves an evaluation of the secondary or <u>indirect</u> environmental effects of the proposed action. Secondary impacts include the social, economic, and environmental effects that would result from the additional population growth enabled by development of a new water supply source. Since the proposed capacity of the North Bay Aqueduct would be 115 cfs for all alignments the secondary impacts associated with population growth would be essentially the same for each alignment. In some respects, the evaluation in Section 6.2 of secondary environmental impacts overlaps with and refers to the analysis of water supply alternatives included as Chapter 3.0 of this report.

6.0.3 Cumulative environmental effects are the focus of the third level of analysis. A *cumulative effect* is defined in the State Guidelines for Implementation of the California Environmental Quality Act (Section 15023.5) as "the change in the environment which results from the incremental impact of the project when added to other closely related past, present, and reasonably foreseeable future projects". The discussion of cumulative effects in this report is directed toward three major public works projects either currently under construction or proposed in the project area that, when coupled with North Bay Aqueduct construction, could significantly compound a number of environmental impacts.

6.1 PRIMARY ENVIRONMENTAL EFFECTS

6.1.1 CONSTRUCTION IMPACTS

6.1.1.1 <u>Environmentally Sensitive Areas</u>

6.1.1.1.1 There are several areas of geological concern in constructing the aqueduct along the various alignments. All of the alignments would be susceptible to seismic damage that could be associated with the Green Valley fault system west of Cordelia (Figure 5-1). Seismic events could also disrupt the aqueduct by causing liquefaction and subsidence of underlying soils. The liquefaction potential is particularly high in the area west of Fairfield and Suisun City (Routes 2-7) where a high ground water table underlies sandy agricultural soil (Figure 6-10). Although buried pipelines generally respond well under conditions of

liquefaction, the pipeline could rise toward the surface and require reburial.

6.1.1.1.2 Routes 2 through 7 to the South Cordelia Forebay would cross the Suisun Marsh near Thomasson and would be constructed on bay mud, a soft, compressible material that could cause differential settling of the pipeline structure (Figure 6-5). Route 7 would also cross bay mud in the northeastern portion of the Marsh near Denverton (Figure 6-8).

6.1.1.1.3 In the eastern portions of the open canal Routes 2 and 6, the high clay content of underlying soils could create the potential for shrink-swell problems during construction (Figure 6-6 and 6-7). Soils with a relatively high content of silt, and consequently higher potential to generate dust and other particulate matter during excavation of the pipeline and/or canal are found along Route 1 northeast of Fairfield and along Routes 2 through 7 west of Suisun City (Figures 6-2 and 6-10).

6.1.1.1.4 Many of the alignments cross areas of prime agricultural soils (Class I and II according to USDA Soil Conservation Service ratings) and construction of an aqueduct would disrupt these resources (see Section 6.1.1.3). The more significant stretches of prime agricultural soils crossed by the various alternative alignments include the eastern and western portions of Route 1 and Routes 2 through 7 west of Suisun City (Figures 6-1, 6-4, and 6-10).

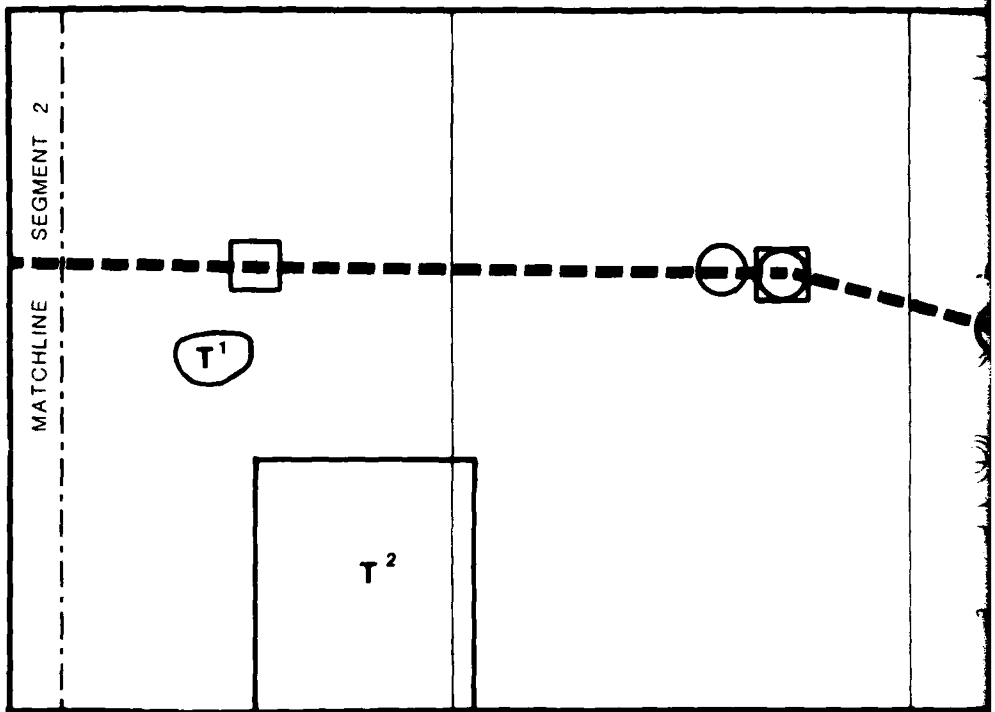
6.1.1.1.5 Each alignment would intersect numerous streams and drainage channels. Route 1 would cross the most waterways (approximately 17), many of which are intermittent. The alignments for Routes 2 through 7 to the South Cordelia Forebay would cross Cordelia Creek (Plate 9b). Pipelines would be located beneath streambeds while canal alternatives would be bridged over affected waterways in most areas, confining the stream drainage to a culvert. Construction of the aqueduct also has the potential to disturb subsurface irrigation and drainage systems in agricultural areas. This impact could be particularly evident along the eastern portions of Route 1 near Cache Slough where land use is primarily in irrigated agriculture (Figure 6-1).

6.1.1.1.6 High ground water levels are present in the eastern portions of the Route 1 alignment near Cache Slough and in the southwestern portions of all the routes near Suisun City. In these areas dewatering may be required during trench excavation. Extensive dewatering could cause some subsidence of surrounding ground levels.

6.1.1.1.7 Flood areas associated with a 100-year storm event occur along segments of all of the alternative alignments. Flooding during construction could disrupt construction activity, flood trenches, and deposit silt and other material in the trenches. If construction across existing levees adversely affected their stability, local flooding hazard would be increased.

6.1.1.1.8 Although none of the alignments would directly pass through any vernal pools, it has been suggested that aqueduct construction could indirectly disrupt vernal pool hydrology by altering the underlying soil strata. Recent test borings taken along Route 2 have indicated that because of the apparent location, depth, and impermeability of underlying clay layers in this area, construction of the aqueduct would probably not affect surrounding vernal pools. /1/ However, the extent and characteristics of these subsurface clay layers along the other alignments have not been thoroughly investigated.

6.1.1.1.9 Dredging activities in the vicinity of the three possible intake points would cause a temporary siltation of the affected sloughs. This impact would be most severe along Calhoun Cut, where nearly 170,000 cubic yards of material would have to be dredged along an approximately 3-mile reach. Cache Slough would require about 30,000 cubic



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PROJECT FEATURES	Routes 1 and 3		buried 6
LAND USE	Grazing Ag. — Irrigated Ag.	Irrigated Ag. — Grazing Ag.	
GEOLOGY/SOILS	Alluvium Class IV		
HYDROLOGY	Alamo Creek	Ulatis Creek	inte flood
VEGETATION/WILDLIFE	2°sensitivity vernal pool dodder 1 Delta green ground beetle 2	2°sensitivity	Mixed A
TRAFFIC	Rio-Dixon Rd. parallels Brown Rd.	S.N. RR	
UTILITIES		gas/electric	
SPECIAL FEATURES	vernal pools		
IMPACT SUMMARY	Moderate impact area: roadways, waterways, unique species, farmland encumberance	Moderate impact area: roadways, waterways, farmland encumberance	Low encu

RP 3 RP 2

T^5 Threatened, endangered and unique plant and wildlife population (Δ-population prior to 1945)

Utility Crossing

Archaeological Sensitivity

Pump Station

Surge Tower

Waterway Crossing

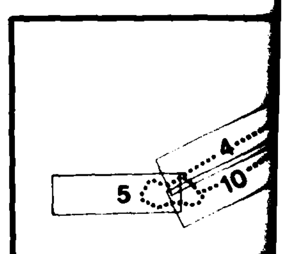
Road/Railroad Intersection

Photographic Reference

Aqueduct/Pipeline

RP 8 Reference Point

X Fault Crossing



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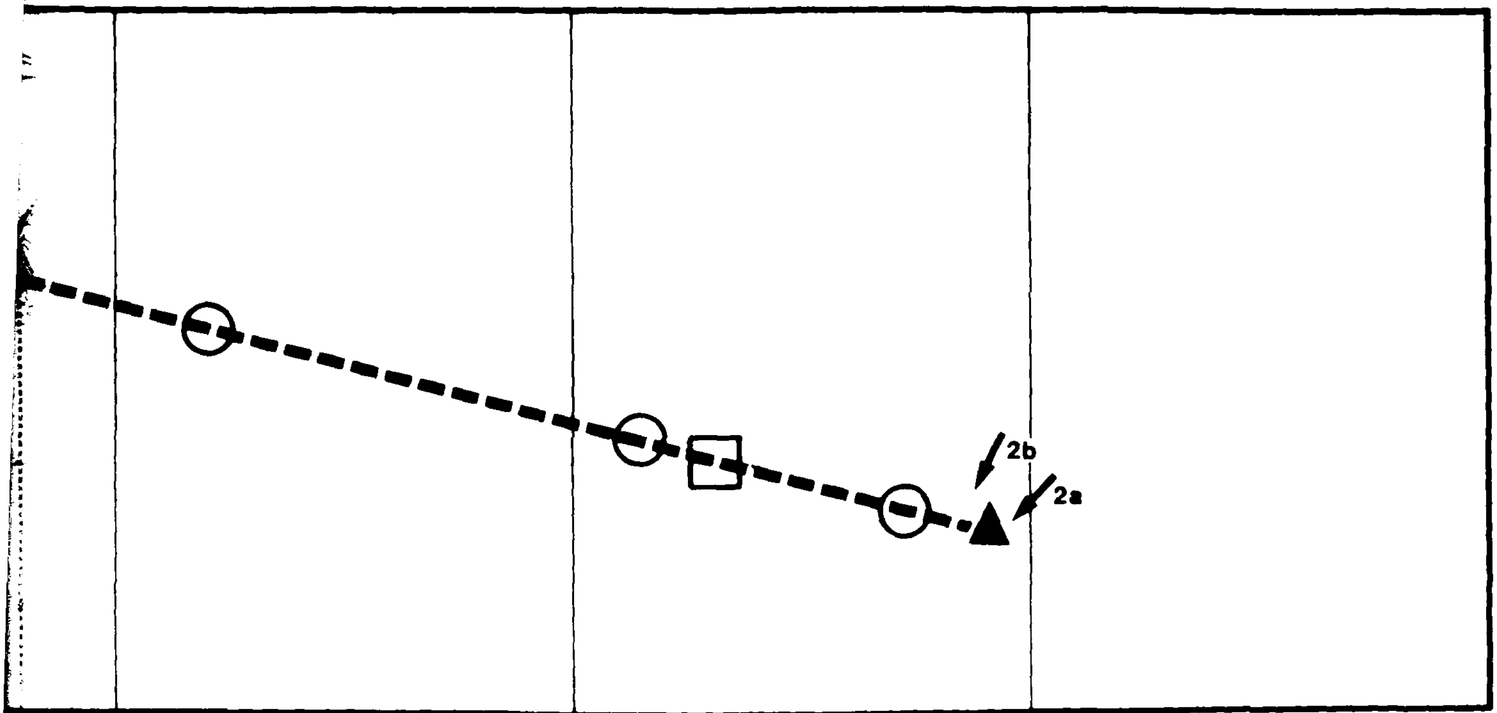
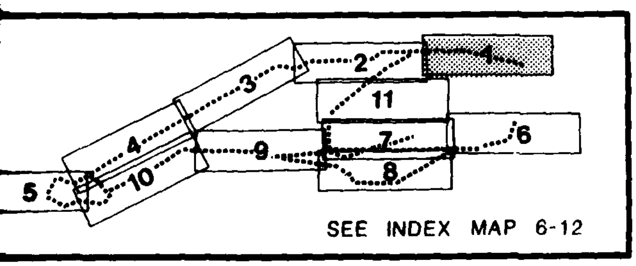


	RP 2 – RP 1	RP 1 – RP 0	RP 0 –
and 3	buried 60" pipe		Initial dredging of approx. 30,000 cu. yds. Cache Slough Pump Station, Dredge spoils disposal area
ng Ag.	Irrigated Ag.		
older Alluvium			
Class II			
reek	intermittent stream drainage ditch	irrigation ditch	Cache Slough
	flood areas		
Mixed Ag./Grassland			riparian
RR		levee	
		gas electric	
terways,	Low to moderate impact area: farmland encumberance	Moderate to high impact area: initial and maintenance dredging, farmland encumberance	

RP 2 RP 1 RP 0



SEE INDEX MAP 6-12

SEGMENT MAP 1

DEPARTMENT OF WATER RESOURCES

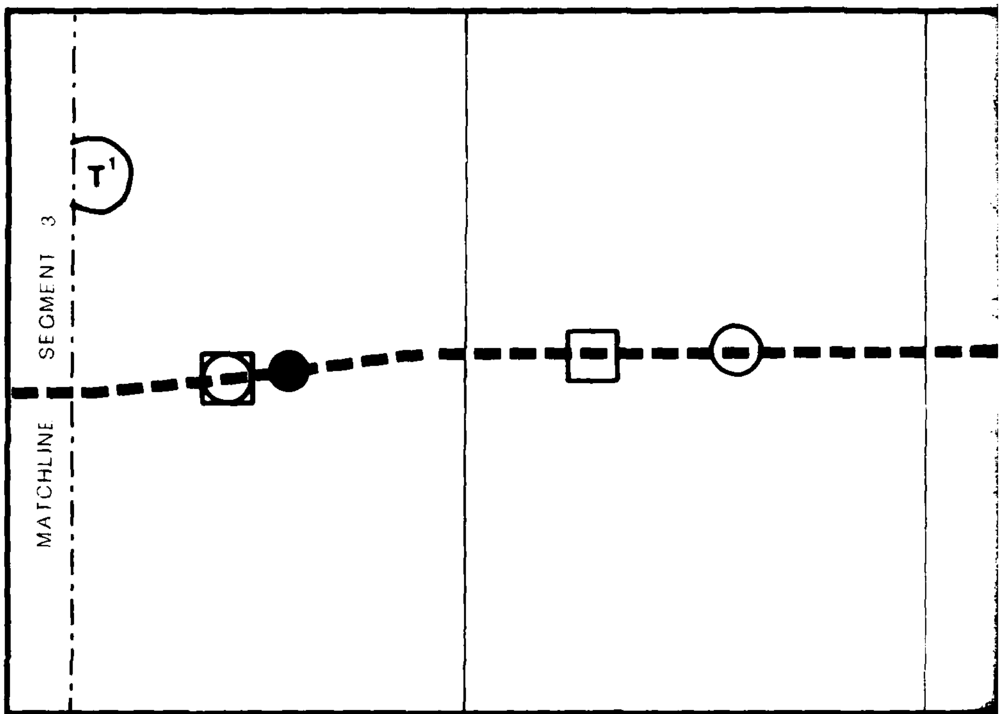
FIG. 6-1

by Madrone Associates

N

0 3000 ft.
0 1000 m

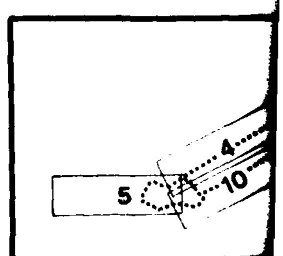
SHEET 2of 11



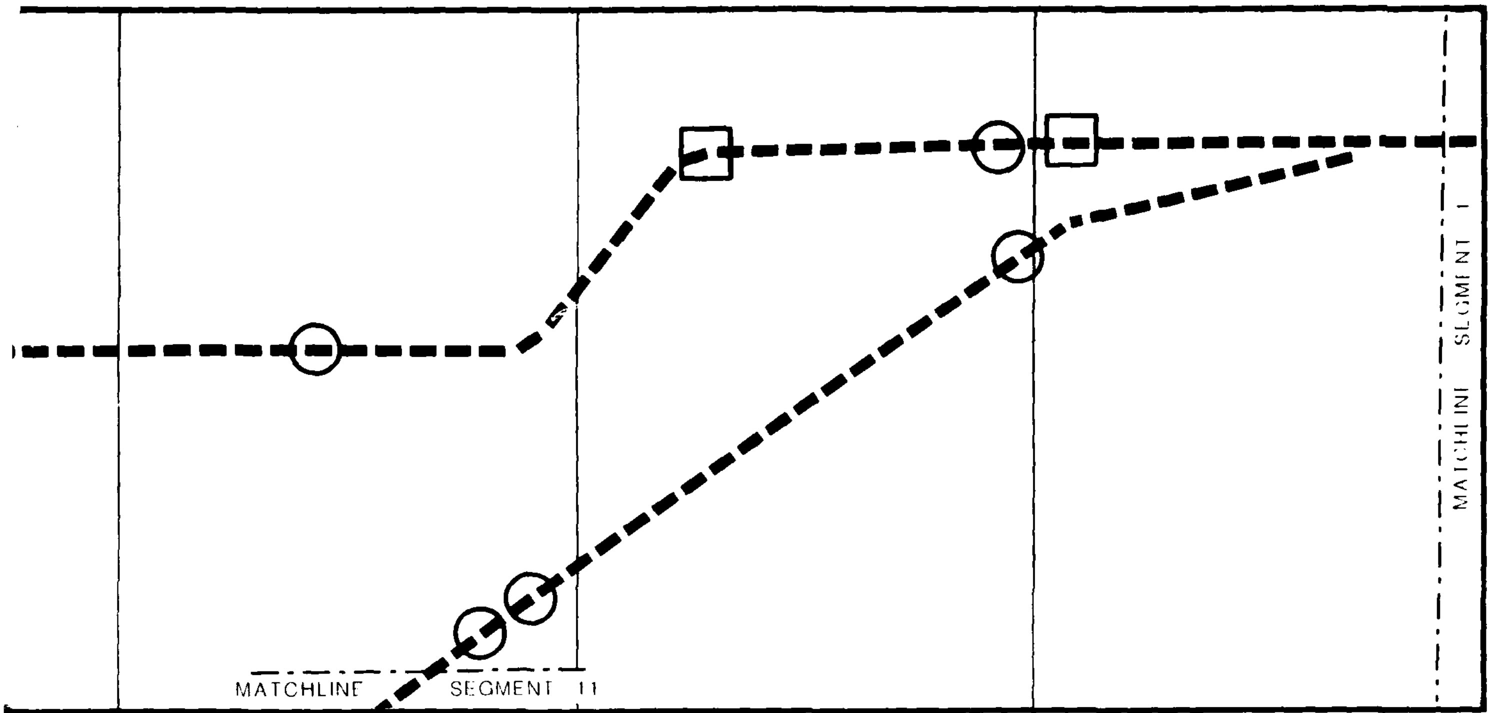
PROJECT FEATURES	Route 1		buried 60
LAND USE	Grazing Ag. / Irrigated Ag.	Irrigated Ag.	
GEOLOGY/SOILS	Alluvium; Class II / Class IV / Class II	Alluvium; Class II	
HYDROLOGY			
VEGETATION/WILDLIFE	Contra Costa baeria [1]		
TRAFFIC	North Gate Rd.	Meridian Rd.	
UTILITIES	14" water	electric	
SPECIAL FEATURES			
IMPACT SUMMARY	Low impact area: roadway, farmland encumberance	Low impact area: roadway, farmland encumberance	Low i... encu...

RP 7 RP 6

T[5]	Threatened, endangered and unique plant and wildlife population (Δ-population prior to 1945)		Waterway Crossing
○	Utility Crossing	□	Road/Railroad Intersection
A	Archaeological Sensitivity	← 2	Photographic Reference
▲	Pump Station	■■■	Aqueduct/Pipeline
●	Surge Tower	RP 8	Reference Point
		X	Fault Crossing

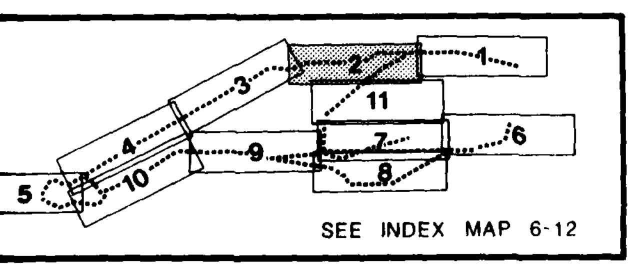


Prepared by Madrone Ass



Route 1 buried 60" pipe			
	Route 3 buried 60" pipe		
...ted Ag.	Grazing Ag.		
	Grazing Ag. (Rt. 3)		
	older Alluvium		
	Class IV		
intermittent streams	intermittent streams		
	flood area		flood area
Mixed Ag./Grassland			
	1° sensitivity (Rt. 1)		
	1° sensitivity (Rt. 3)		
	Dally Rd.	Burke Lane	
electric	electric (Rt. 3)	gas 230 kv electric	
	vernal pools		
Low impact area: utilities, farmland encumberance, irrigation drainage	Moderate impact area: utilities, unique species, farmland encumberance (1 & 3)	Moderate impact area: roadways, utilities, unique species, farmland encumberance (1 & 3)	

RP 6 RP 5 RP 4

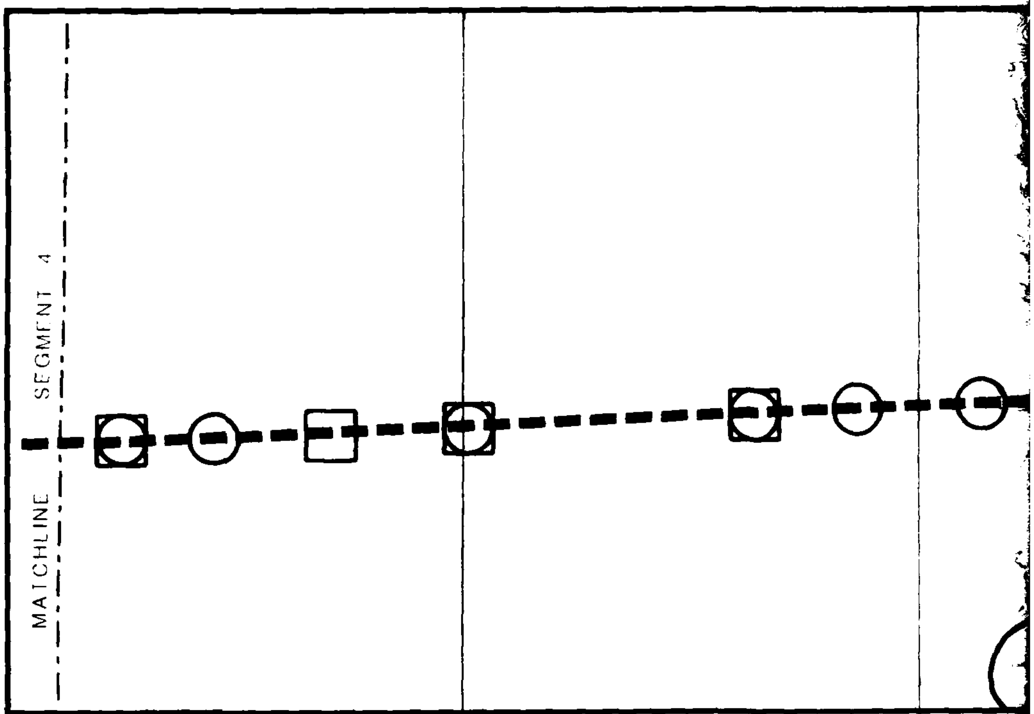


...by Madrone Associates

SEGMENT MAP 2

DEPARTMENT OF WATER RESOURCES

FIG. 6-2



0 3000 ft.
0 1000 m

SHEET 3of 11

PROJECT FEATURES	Route 1		buried 60" p
LAND USE	Urban/Residential	Grazing Ag. — irr. Ag.	Grazi
GEOLOGY/SOILS	Class II — Class I; high silt	Class I; high silt	Alluvi
HYDROLOGY		Laurel Creek flood area	
VEGETATION/WILDLIFE	Urban		Contra C
TRAFFIC	N. Texas St.; Dover Ave.	Air Base Parkway; Fank Rd.	parallels N.
UTILITIES	water and sewer; Linear Park (Phase III)	water and sewer; Linear Park (Phase III)	
SPECIAL FEATURES			
IMPACT SUMMARY	High impact area: roadways, utilities, noise, dust, park	Moderate to high impact area: roadways, utilities, flooding, noise, dust, farmland encumberance	Moderate

RP 11 RP 10

T^s *Threatened, endangered and unique plant and wildlife population (Δ-population prior to 1945)*

Utility Crossing

A Archaeological Sensitivity

Pump Station

Surge Tower

Waterway Crossing

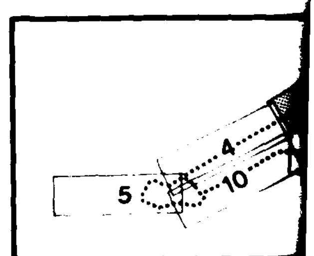
Road/Railroad Intersection

Photographic Reference

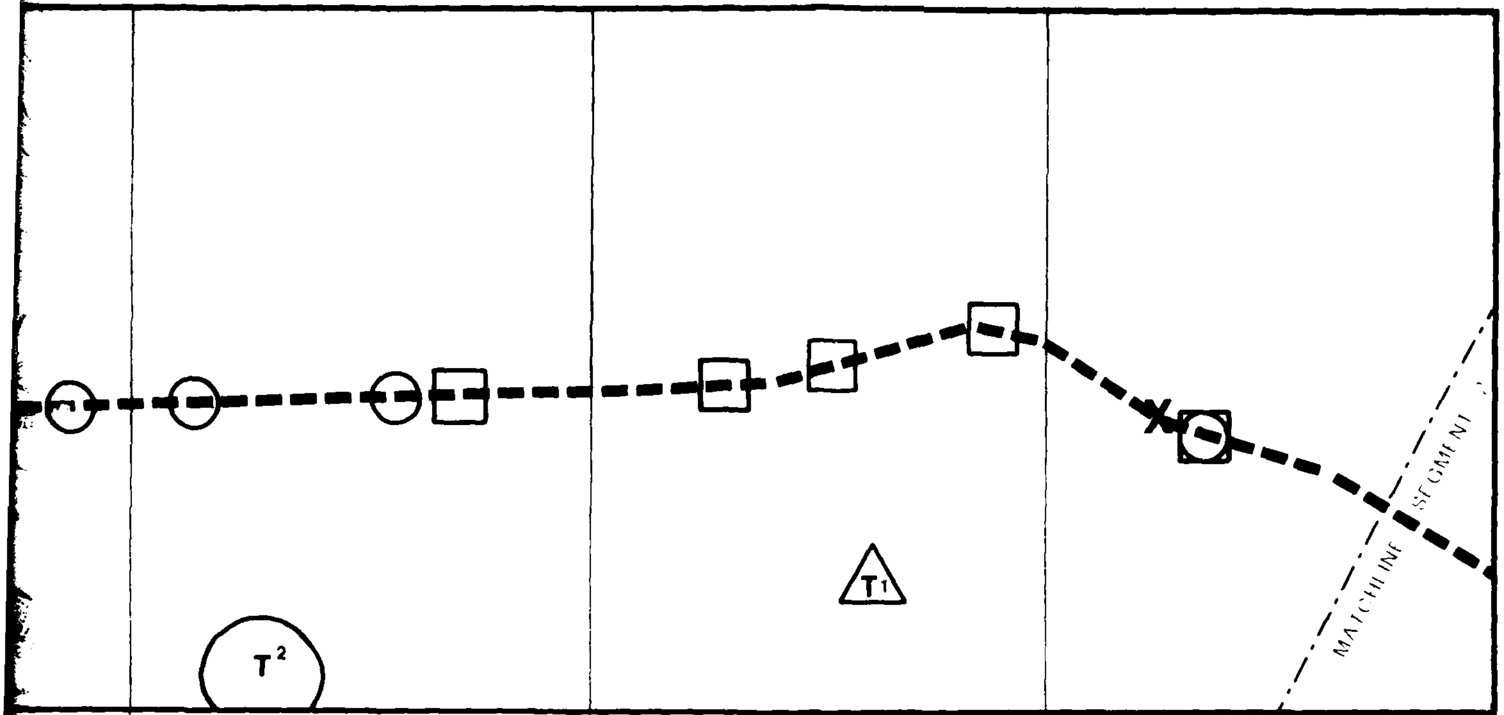
Aqueduct/Pipeline

RP 8 Reference Point

X Fault Crossing



Prepared by Madrone Associ



ute 1 buried 60" pipe

Grazing Ag. | Irrigated Ag. | Grazing Ag.

Alluvium | older Alluvium

Class IV

Kirby Hills Fault Crossing

intermittent stream · intermittent stream · flood area

Mixed Ag./Grassland

1° sensitivity

Contra Costa baeria[2]

Miniature downingia, Two-fork clover[1]

Bank Rd. · Cement Hill Rd. · Norman Lane · Peabody Rd. · dismantled RR · S.P. RR

parallels N.S. RR

electric

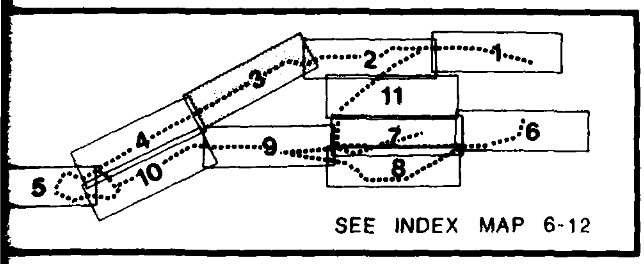
ays, farmland

Moderate impact area: roadways, noise, dust

Moderate to low impact area: roadways, farmland encumberance

Moderate impact area: roadways, farmland encumberance

RP 10 · RP 9 · RP 8



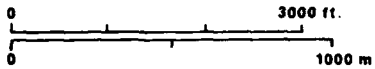
SEE INDEX MAP 6-12

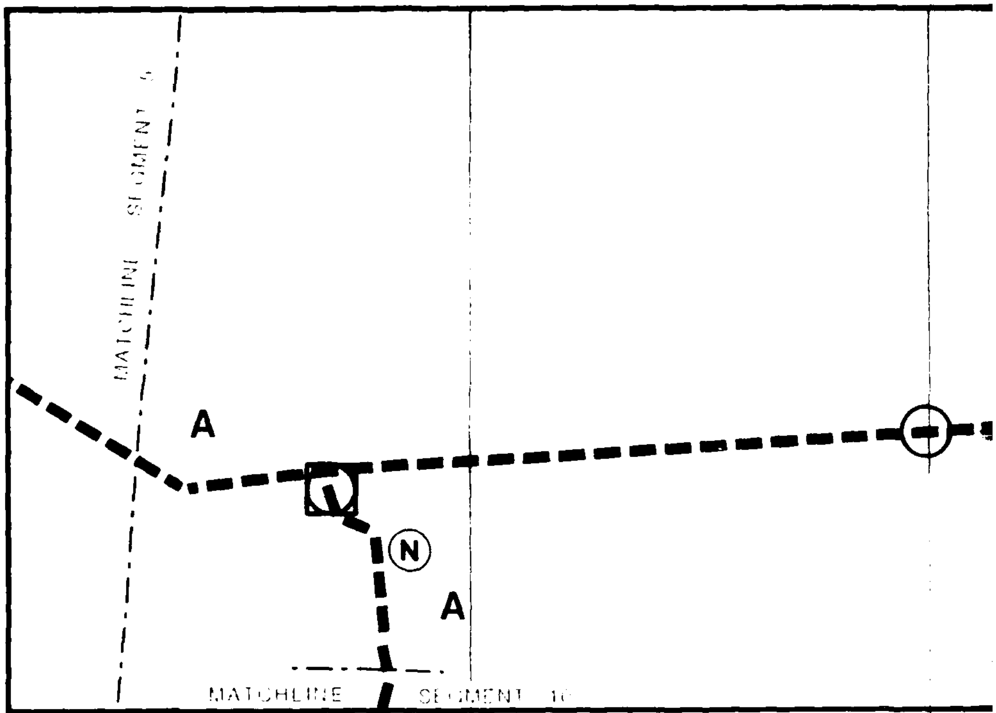
by Madrone Associates

SEGMENT MAP 3

DEPARTMENT OF WATER RESOURCES

FIG. 6-3



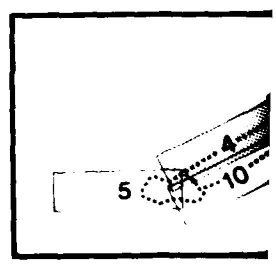


SHEET 4 of 11

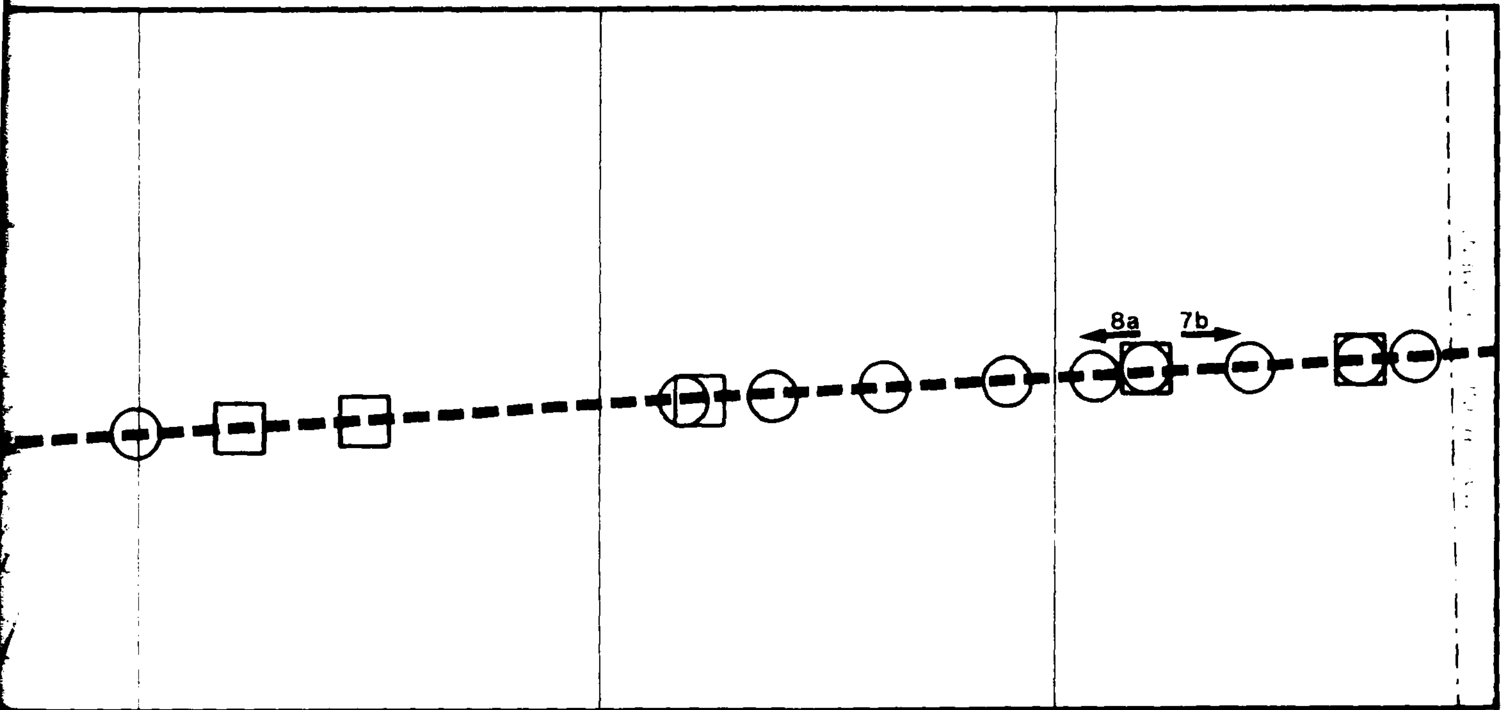
PROJECT FEATURES	(N) North Cordelia Forebay (Rts.2-7)		
LAND USE	Orchard and grazing Ag. (N) Res./Orchard Ag. (Rts.2-7)		Orchar
GEOLOGY/SOILS	Alluvium — Sedimentary rock — Class VIII	Alluvium High silt soils	Alluvium Class I
HYDROLOGY	intermittent stream flood area	Suisun Creek flood area	
VEGETATION/WILDLIFE		Mixed orchard	grassland
TRAFFIC	(N) Interstate 80 (Rts. 2-7)		Ab
UTILITIES	proposed water reservoir electric		electric
SPECIAL FEATURES	Archaeological sites		
IMPACT SUMMARY	Moderate to low impact area: roadways, utilities, farmland encumberance	Moderate to low impact area: flooding, farmland encumberance	Mode farm

RP 15 RP 14

T^5	Threatened, endangered and unique plant and wildlife population (Δ-population prior to 1945)		Waterway Crossing
○	Utility Crossing	□	Road/Railroad Intersection
A	Archaeological Sensitivity	←2	Photographic Reference
▲	Pump Station	■■■	Aqueduct/Pipeline
●	Surge Tower	RP 8	Reference Point
		X	Fault Crossing



Prepared by Madrone Asso



Route 1 buried 6" pipe

Best [illegible] Hospital

[illegible] Ac. | Urban Residential

Alluvium

Class I | Class II

ilt soils

Ledgewood Creek | intermittent stream | intermittent stream

flood [illegible]

d orchard | Grassland Ac. | [illegible]

Abernathy Rd. Chadbourne Rd. | Interstate 80 | Rockville Rd.

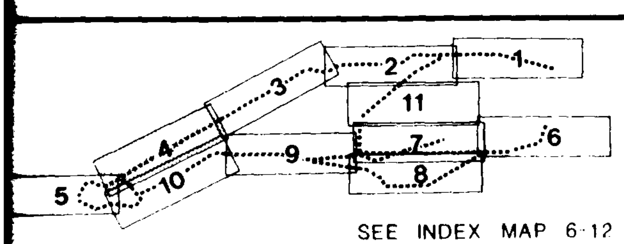
electric | water and sewer

Linear park [illegible]

oding, | Moderate impact area: roadways, farmland encumberance | High impact area: roadways, utilities, noise, dust, Linear Park

RP 14

RP 13



SEE INDEX MAP 6-12

SEGMENT MAP 4

DEPARTMENT OF WATER RESOURCES

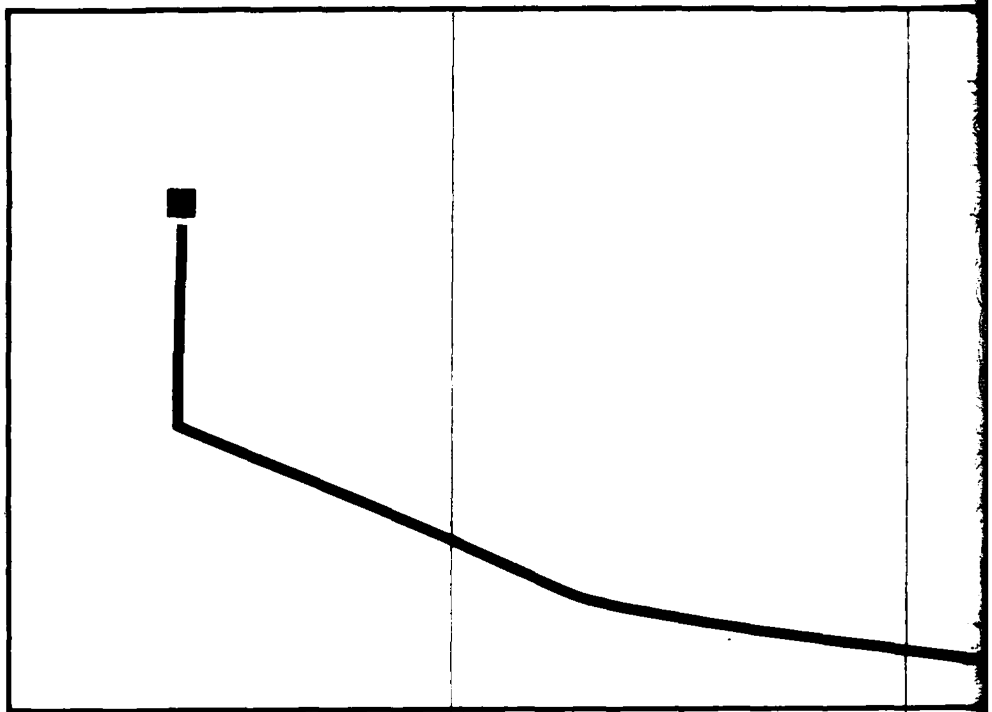
FIG 6-4

ed by Madrone Associates

0 3000 ft.

0 1000 m

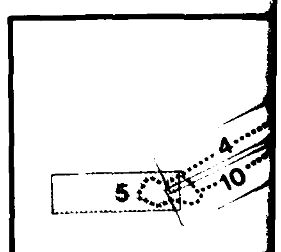
SHEET 5 of 11



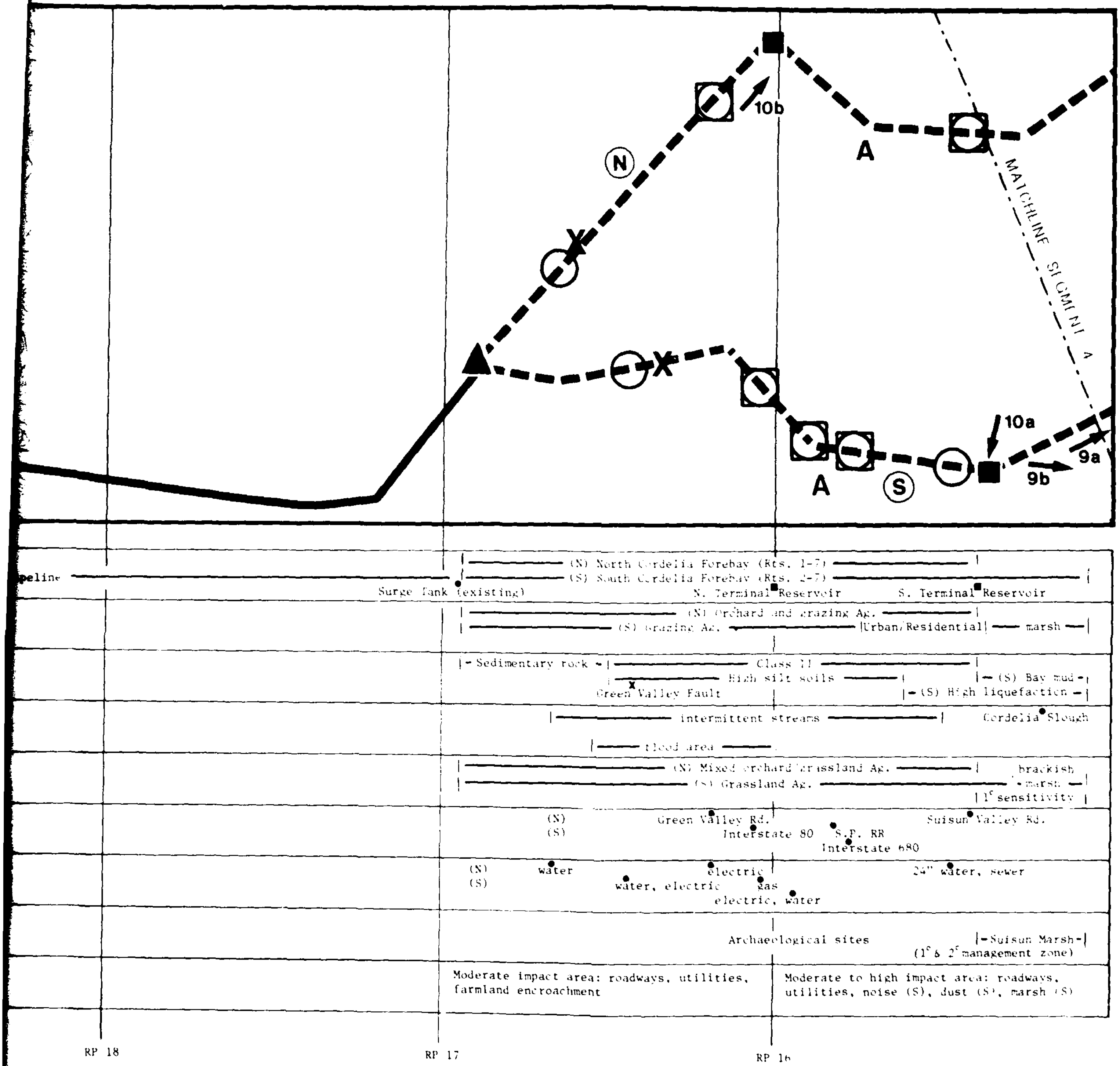
PROJECT FEATURES	EXISTING PHASE I FACILITIES - 36" buried pipeline; Napa Turnout Reservoir
LAND USE	
[illegible]	
[illegible]	
[illegible] WILDLIFE	
[illegible]	
[illegible]	
SPECIAL FEATURES	
IMPACT SUMMARY	

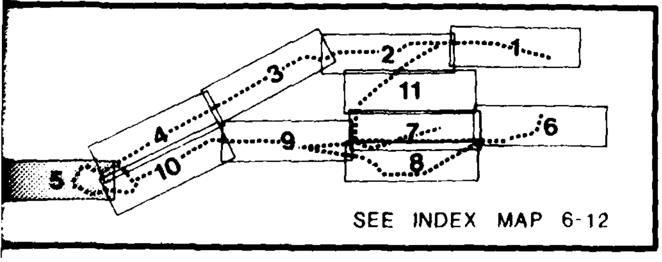
RP 19 RP 18

T^5	Threatened, endangered and unique plant and wildlife population (Δ-population prior to 1945)		Waterway Crossing
○	Utility Crossing	□	Road/Railroad Intersection
A	Archaeological Sensitivity		Photographic Reference
▲	Pump Station	■ ■■ ■	Aqueduct/Pipeline
●	Surge Tower	RP 8	Reference Point
		X	Fault Crossing



Prepared by Madrone Ass[...]



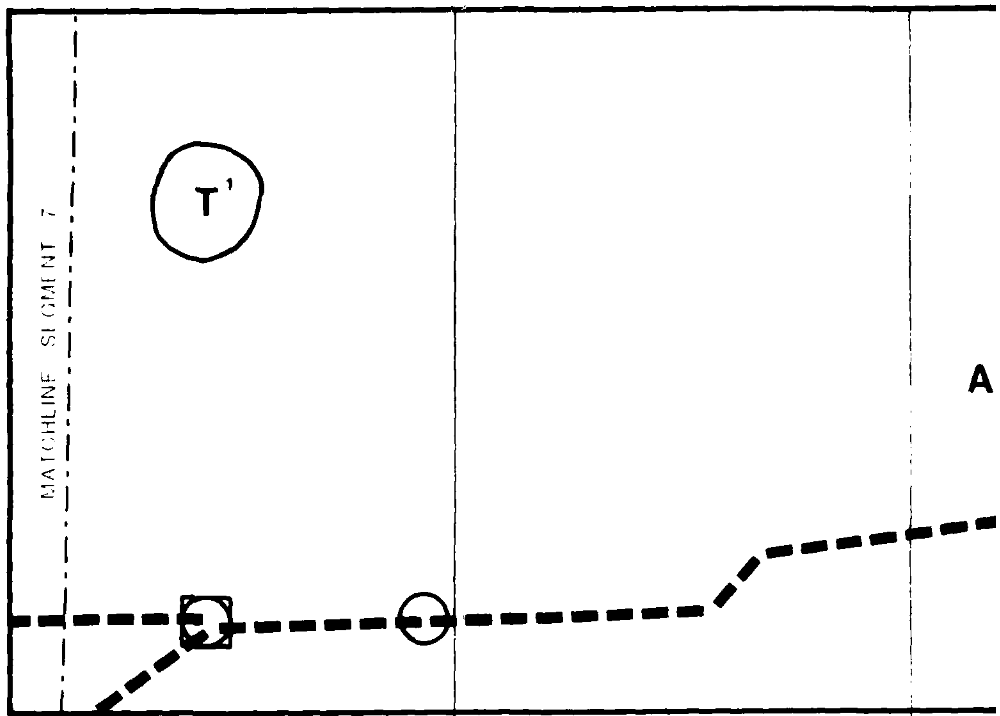


SEGMENT MAP 5

DEPARTMENT OF WATER RESOURCES

FIG. 6-5

[Prepa]red by Madrone Associates



N

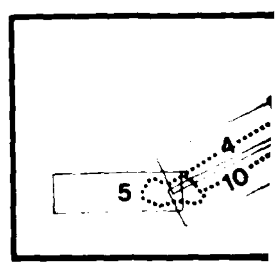
0 3000 ft.
0 1000 m

SHEET 6 of 11

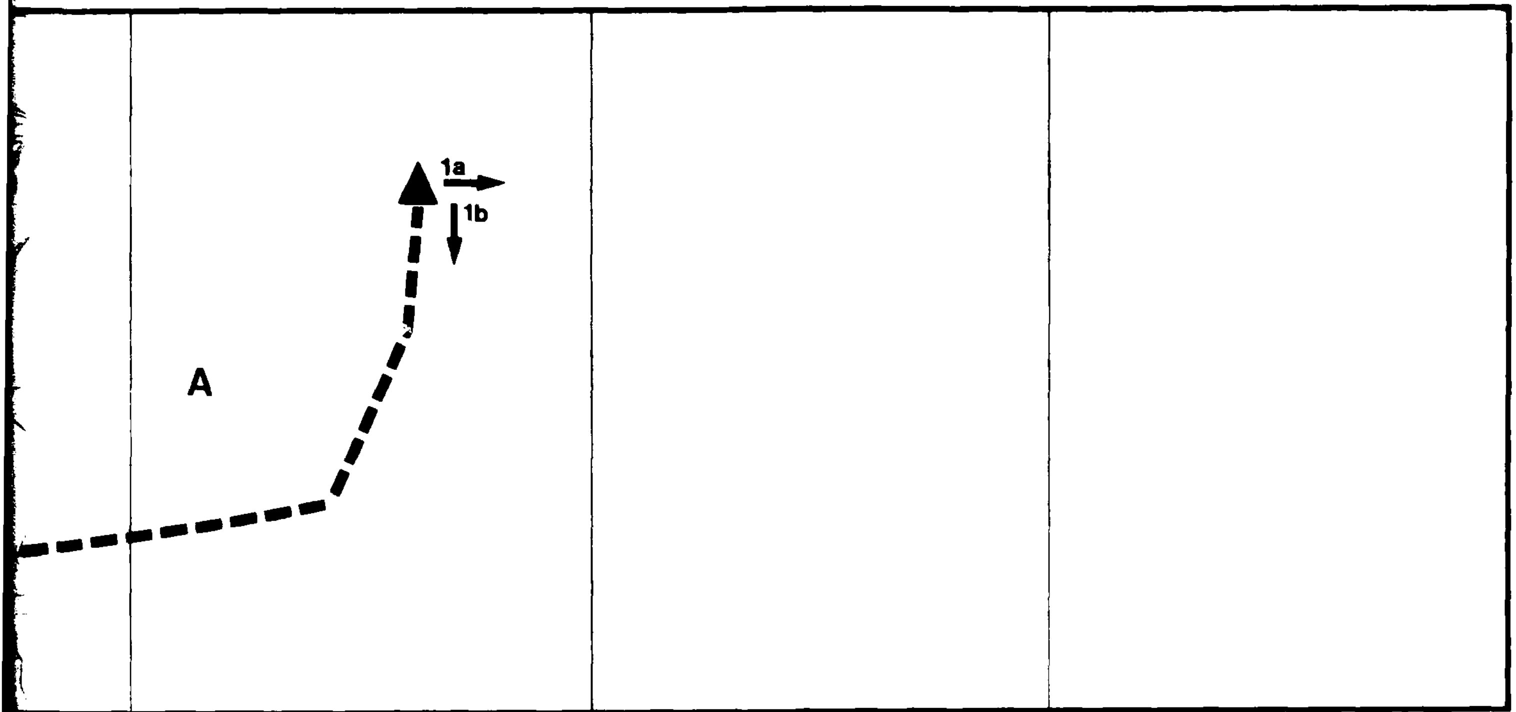
PROJECT FEATURES	Routes 4 and 5 buried 60" pipe; Route 6 open canal Route 7 buried 60" pipe		
LAND USE	Grazing Ag.	Irrigated Ag.	
GEOLOGY/SOILS	older Alluvium Class IV High shrink-swell potential (Rt.6)		
HYDROLOGY	intermittent streams flood area flood area	Big Ditch flood area	
VEGETATION/WILDLIFE	mixed grassland 1° sensitivity (7) Legenere[1] 2° sensitivity		1° sensi
TRAFFIC	Rio Dixon Rd. parallels Creed/Robinson Rd.		
UTILITIES	gas substation 230kv electric		
SPECIAL FEATURES	Jepson Prairie		Archa
IMPACT SUMMARY	Low to moderate impact area: roadways, utilities, farmland encumberance (4,5,7)/ encroachment (6)	Low impact area: farmland encumberance (4,5,7)/encroachment (6)	Moderat species

RP 23 RP 22

- T^5 Threatened, endangered and unique plant and wildlife population (Δ-population prior to 1945)
- Utility Crossing
- A Archaeological Sensitivity
- Pump Station
- Surge Tower
- Waterway Crossing
- Road/Railroad Intersection
- Photographic Reference
- Aqueduct/Pipeline
- RP 8 Reference Point
- X Fault Crossing



Prepared by Madrone Asso



Dredging 300 cu. yds.
Lindsey Slough Pump Station

rigated Ag. — |-Grazing Ag. — |

| — Class II — |

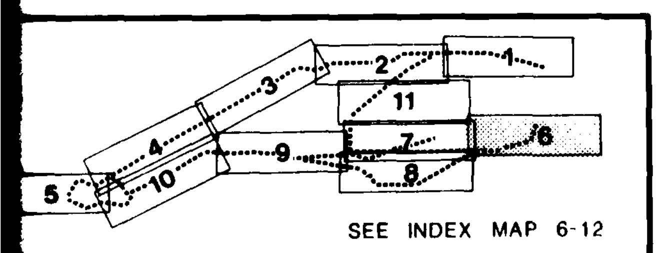
Ditch
area
Lindsey Slough irrigation ditch
| — flood area — |

| — riparian — |
| — 1° sensitivity — |
anadromous fisheries

Archaeological sites

(6)
Moderate impact area: initial and maintenance dredging, unique species, farmland encumberance (4,5,7)/encroachment (6)

RP 22 RP 21 RP 20



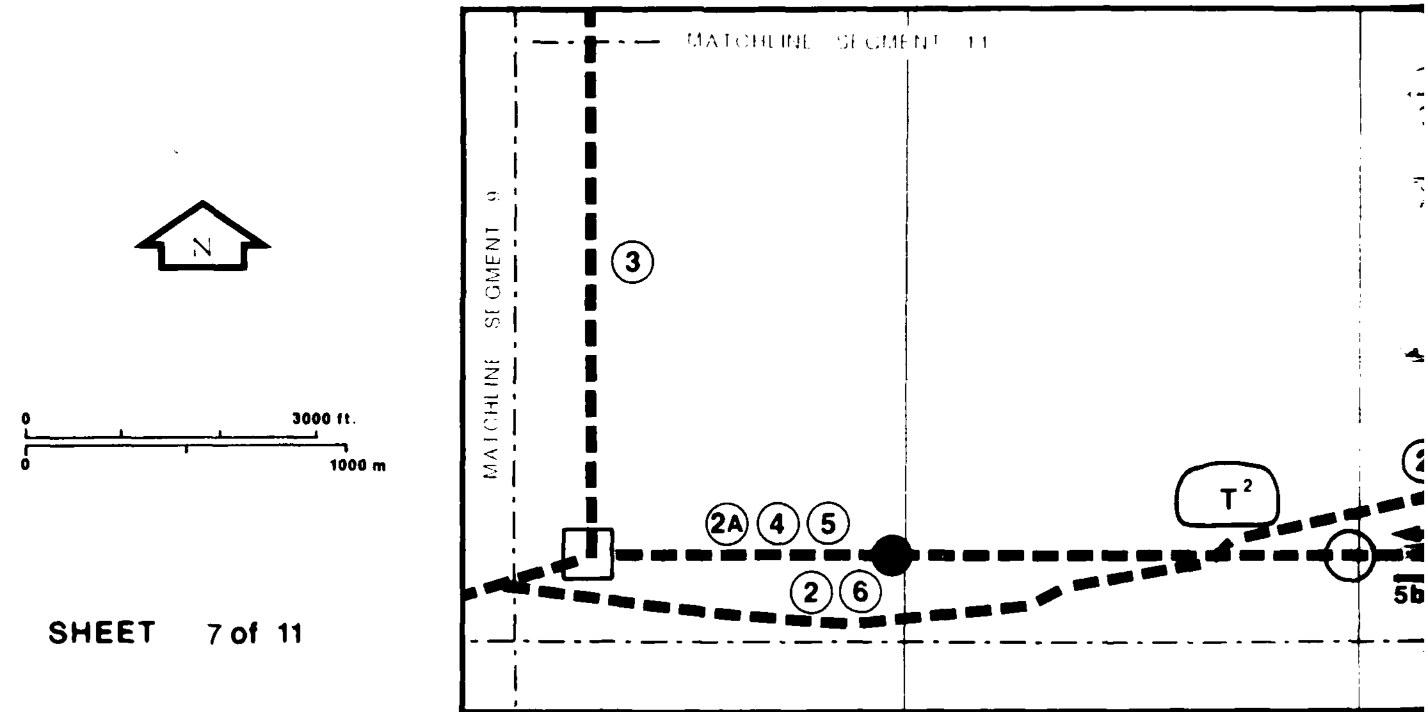
by Madrone Associates

SEGMENT MAP 6

DEPARTMENT OF WATER RESOURCES

FIG. 6-6

SHEET 7 of 11



PROJECT FEATURES			
LAND USE			
GEOLOGY/SOILS	Older Alluvium; Class IV		Tehama Fo
HYDROLOGY	intermittent stream; flood area	intermittent stream; Denverton creek; flood area	
VEGETATION/WILDLIFE	1° sensitivity (2,6); 2° sensitivity (5)	Hispid bird's-beak 2	...sed gr
TRAFFIC	S. Meridian Rd.		parall
UTILITIES	parallels electric...		...30 & 500
SPECIAL FEATURES	vernal pools		lepso
IMPACT SUMMARY	Low to moderate impact area: roadways, utilities, unique species (2,6), farmland encumberance (2A,4,5,7)/encroachment (2,6)	Low to moderate impact area: unique species (2,2A), utilities (2,2A,5,6), farmland encumberance (2A,5,7), encroachment ...	Low t... speci... (2A,5...

RP 27 RP 26

T[5] Threatened, endangered and unique plant and wildlife population (Δ-population prior to 1945)

○ Utility Crossing

A Archaeological Sensitivity

▲ Pump Station

● Surge Tower

Waterway Crossing

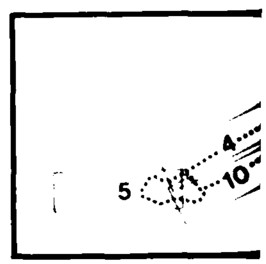
□ Road/Railroad Intersection

Photographic Reference

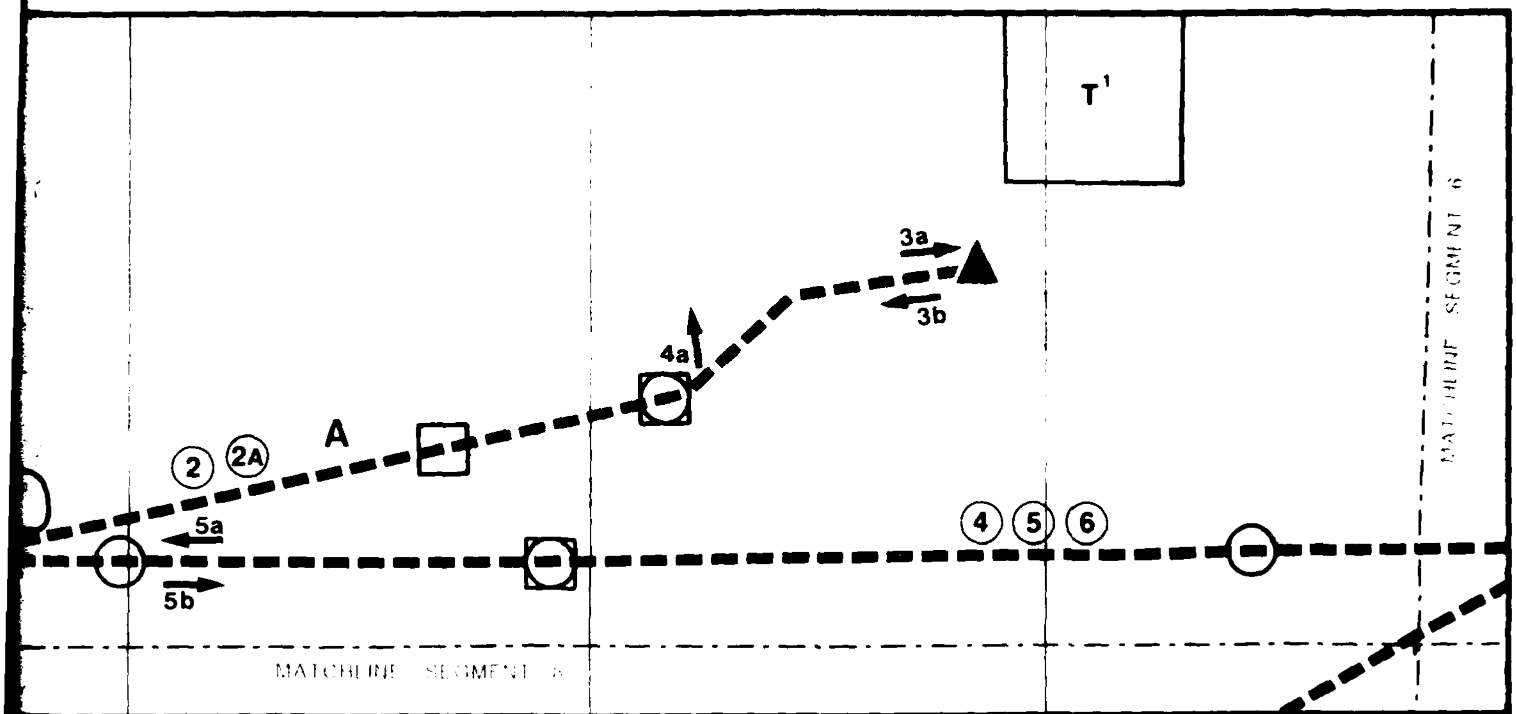
Aqueduct/Pipeline

RP 8 Reference Point

X Fault Crossing



Prepared by Madrone Asso...



Routes 2A,6 open canal
Routes 2,3,4,5,7 buried 60" pipeline
Calhoun Cut Pump Station (Rts. 2,2A)-Initial dredging 168,000 cu.yd.

Grazing Ag.

Tehama Formation | Older Alluvium
Class III | Class IV
High shrink-swell potential (Rts. 2,6)

intermittent stream; flood area | intermittent stream; flood area | intermittent stream; flood area | Calhoun Cut (2,2A); flood area | intermittent stream; flood area

...eak 2 mixed grassland/scattered trees | riparian (2,2A)
1° sensitivity (2,2A)
2° sensitivity (5,6) | Delta green ground beetle 1

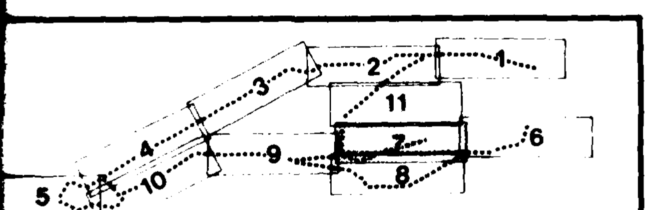
abandoned RR | S.N. RR | S.N. RR
parallels Creed Rd.

230 & 500 Kva electric | electric | gas
(4,5,6) | parallels gasline (2A,4,5,6)

Jepson Prairie
Archaeological sites

...species ...nd (2,6)	Low to high impact area: utilities, unique species (2,2A), farmland encumberance (2A,5,7)/encroachment (2,6)	Low to high impact area: dredging (2,2A), riparian disruption (2,2A), utilities, farmland encumberance (2A,5,7)/encroachment (2,6)	Low to high impact area: dredging (2,2A), riparian disruption (2,2A), utilities, unique species (2,2A,7), farmland encumberance(5,7)/encroachment (6)

RP 26 | RP 25 | RP 24



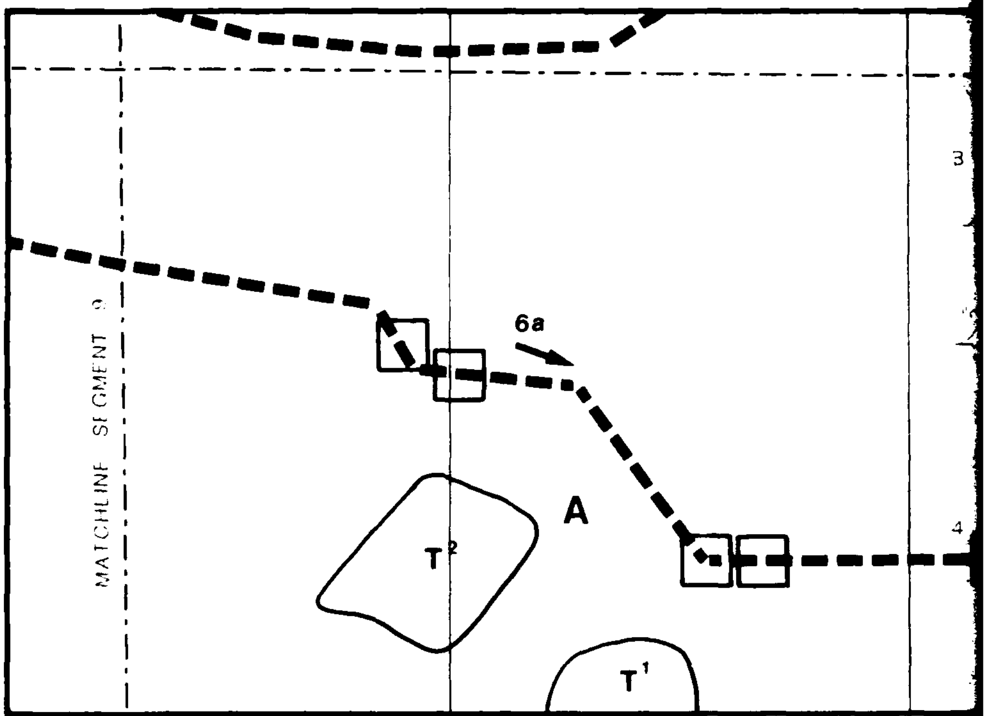
SEE INDEX MAP 6 12

SEGMENT MAP 7

DEPARTMENT OF WATER RESOURCES

FIG. 6-7

...d by Madrone Associates



N

0 — 3000 ft.
0 — 1000 m

SHEET 8 of 11

PROJECT FEATURES			
LAND USE			
GEOLOGY/SOILS	Older Alluvium	Older Alluvium	Tehama Formation
HYDROLOGY	Intermittent stream flood area	Denverton Creek flood area	
VEGETATION/WILDLIFE	brackish marsh 1° sensitivity (probable habitat) Salt marsh harvest mouse 2	brackish marsh 1° sensitivity Miniature downingia 1	Mixed Ag
TRAFFIC	Highway 12 Denverton Rd.	Highway 12 Shiloh Rd.	S.N.
UTILITIES			
SPECIAL FEATURES	(1° & 2° management areas) Suisun Marsh	Archaeological sites	
IMPACT SUMMARY	Low to moderate impact area: unique species, farmland encumberance	High impact area: roadways, Suisun Marsh, unique species, farmland encumberance	Moder util encu

RP 31 RP 30

T[1] Threatened, endangered and unique plant and wildlife population (Δ - population prior to 1945)

○ Utility Crossing

A Archaeological Sensitivity

▲ Pump Station

● Surge Tower

Waterway Crossing

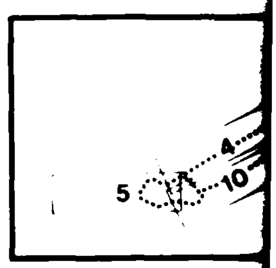
□ Road/Railroad Intersection

Photographic Reference

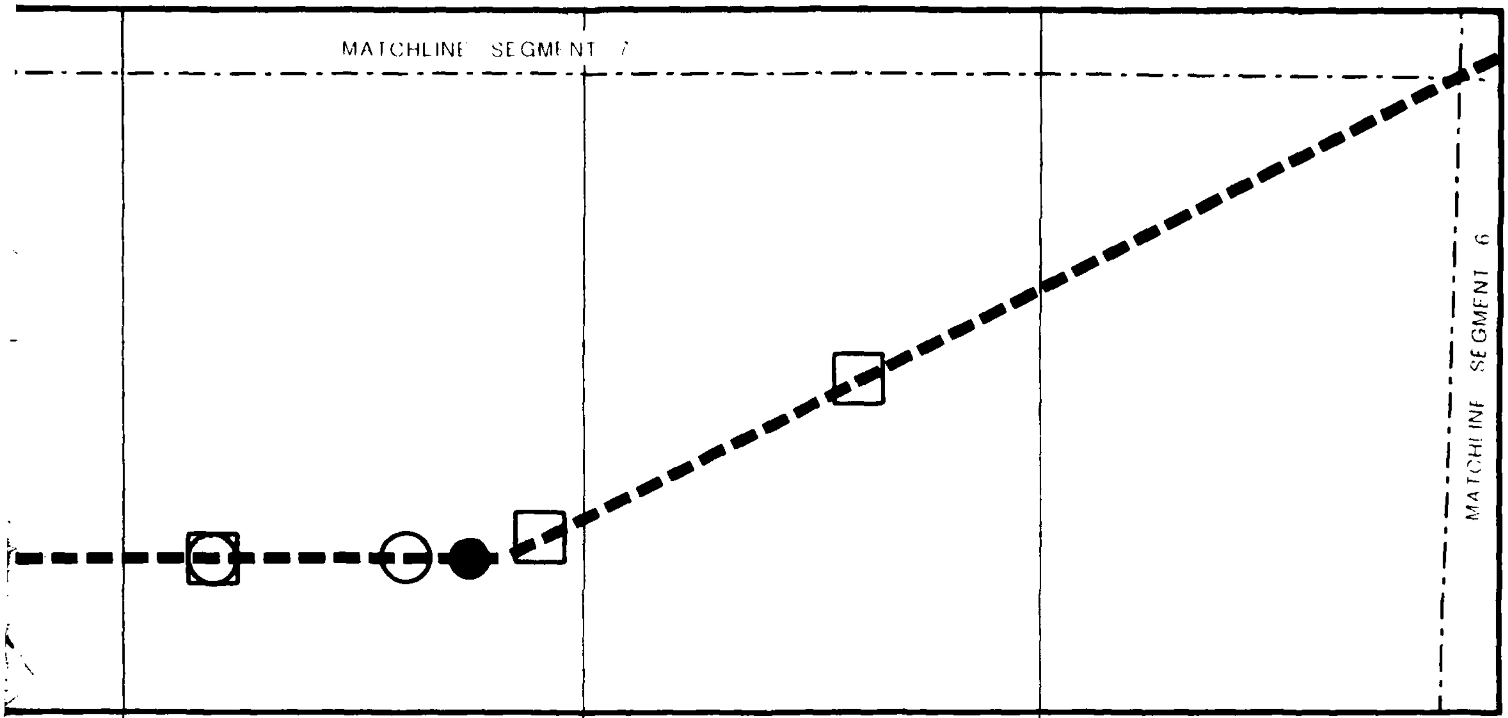
Aqueduct/Pipeline

RP 8 Reference Point

X Fault Crossing



Prepared by Madrone Ass



Route 7 buried 60" pipe

Grazing Ag.

Tehama Formation | Montezuma Formation | older Alluvium
Class IV

intermittent stream · intermittent stream · intermittent stream
flood area · flood area

Mixed Ag./Grassland | grassland
2° sensitivity | 1° sensitivity
ningia[1]

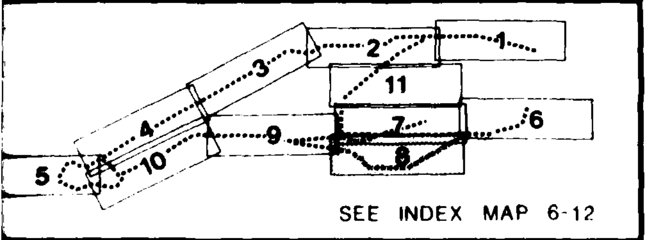
S.N. RR · Lambie Rd. · Goose Haven Rd.

electric

Jepson Prairie

Marsh, nce	Moderate to high impact area: roadways, utilities, unique species, farmland encumberance	Moderate to high impact area: roadways, unique species, farmland encumberance	Moderate to high impact area: unique species, farmland encumberance

RP 30 · RP 29 · RP 28

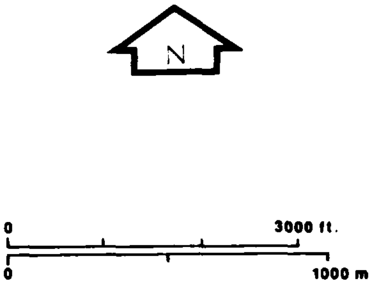


SEGMENT MAP 8

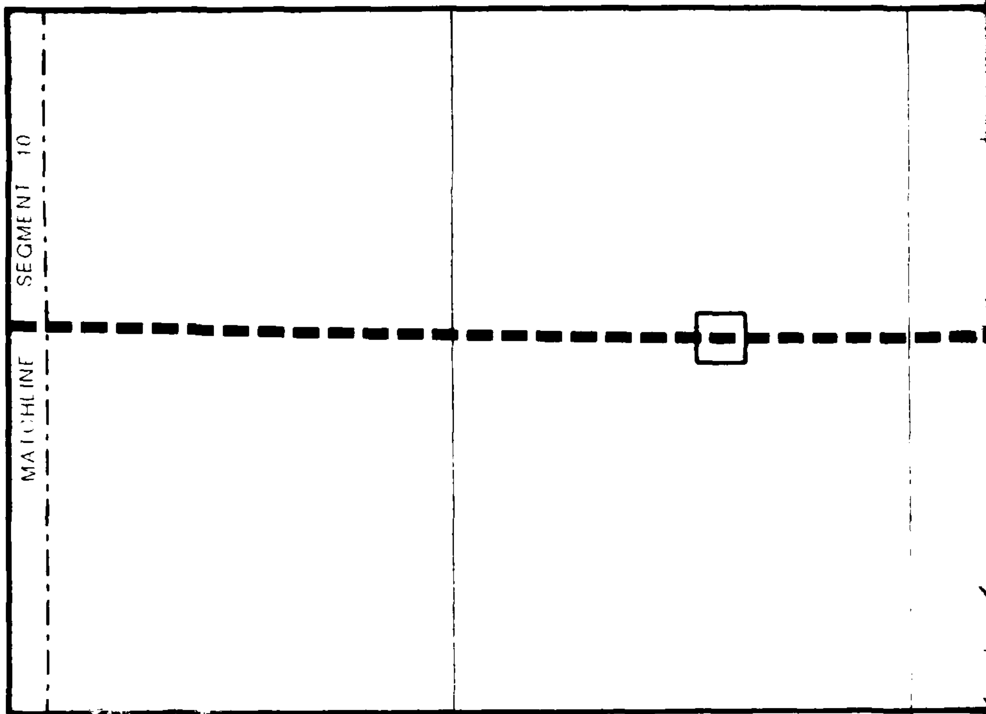
DEPARTMENT OF WATER RESOURCES

FIG. 6-8

by Madrone Associates



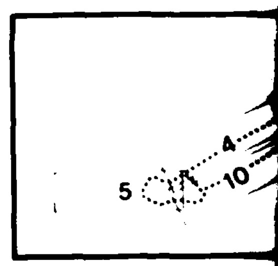
SHEET 9of 11



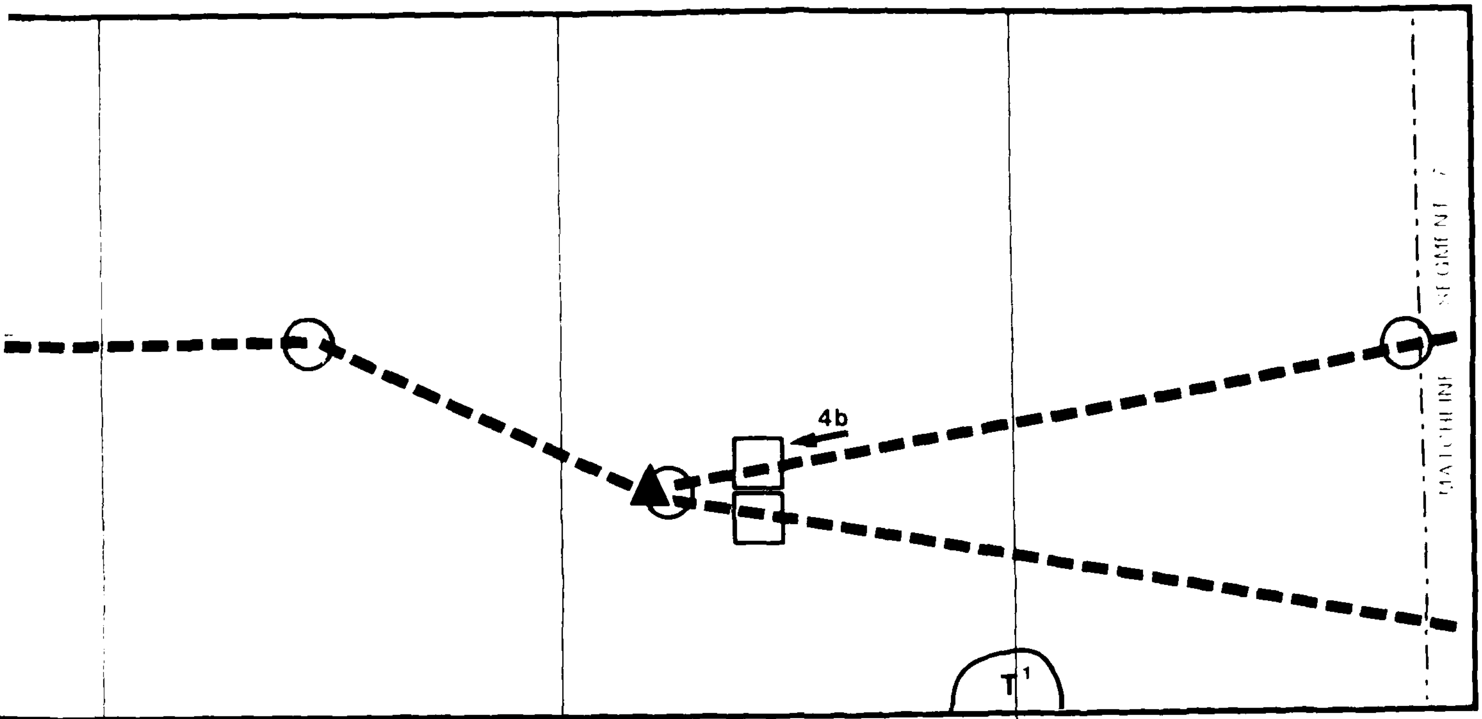
PROJECT FEATURES	[illegible]	[illegible]	
LAND USE			
GEOLOGY/SOILS	Class II; High silt soil		
HYDROLOGY	Laurel Creek; flood area	intermittent stream	intermittent stream; flood area
VEGETATION/WILDLIFE			
TRAFFIC	parallels [illegible]	[illegible] Vista Road	
UTILITIES	parallels gas line		
SPECIAL FEATURES			
IMPACT SUMMARY	Low impact area: farmland encumberance	Low impact area: roadways, farmland encumberance	Low [illegible]

RP 35

T^5	Threatened, endangered and unique plant and wildlife population (Δ-population prior to 1945)		Waterway Crossing
○	Utility Crossing	□	Road/Railroad Intersection
A	Archaeological Sensitivity		Photographic Reference
▲	Pump Station	■ ▬ ■	Aqueduct/Pipeline
●	Surge Tower	RP 8	Reference Point
		X	Fault Crossing



Prepared by Madrone Asso[illegible]



Routes 2,6 open canal; Routes 2A,3,4,5 buried 60" pipe
Route 7 buried 60" pipe
Travis AFB Pump Station (2,6)

Grazing Ag./Vacant — Grazing Ag.

Older Alluvium
Class IV
High shrink-swell potential

intermittent stream — Union Creek — intermittent stream
flood area — flood area

Mixed Ag./Grassland — Contra Costa baeria[1]
2° sensitivity — 1° sensitivity
1° sensitivity

Branscomb Rd.

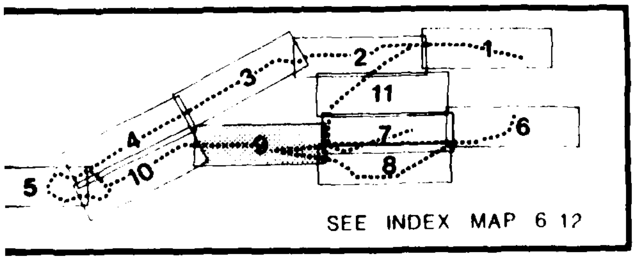
gas and electric — gas and electric

Low impact area: farmland encumberance

Low to moderate impact area: pump station visibility (2,6) unique species, farmland encumberance/encroachment

Low to moderate impact area: unique species, farmland encumberance (2A,3,4,5,7) encroachment (2,6)

RP 34 — RP 33 — RP 32

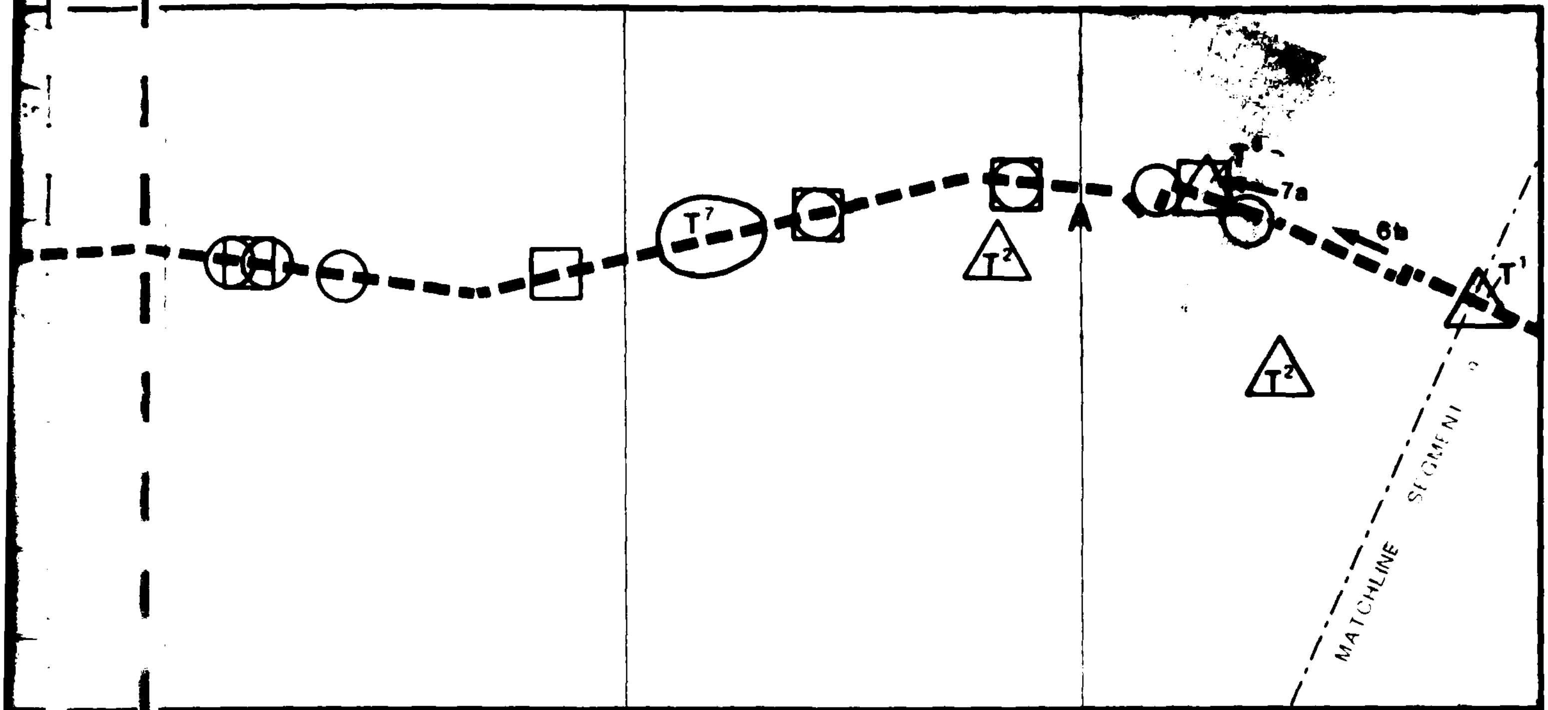


by Madrone Associates

SEGMENT MAP 9

DEPARTMENT OF WATER RESOURCES

FIG. 6-9



Routes 2,2A,3,4,5,6,7 buried 60" pipe
Routes 2,2A,3,4,5,6,7 buried 30" pipe

Grazing Ag./Vacant | Urban/Residential

Class I | Class II

High liquefaction potential | Bay mud, high ground failure risk, high shrink-swell

Ledgewood Creek | intermittent stream | irrigation ditch

flood area

Urban

1° sensitivity

Legenere, Contra Costa baeria 7 | Contra Costa baeria 2 | Legenere 3 | Suisun aster 1

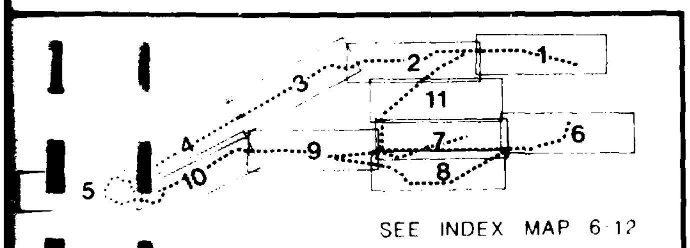
Cordelia Rd. | S.P. RR | Pennsylvania Ave. | S.P. RR | Main St. | Highway 12 bypass | Marina

12" water, 12" sewer, gas | 36" water, 24" sewer (force) | 36" water | 14" fuel, 32" gas line, 36" sewer, 8" water, 36" water, 24" sewer (force)

Suisun Marsh (2° management area) | Archaeological sites and historic structures | Fairfield-Suisun Train Station

farmland encumberance | Moderate to low impact area: roadways, waterways, unique species | High impact area: utilities, roadways, urban area disruption

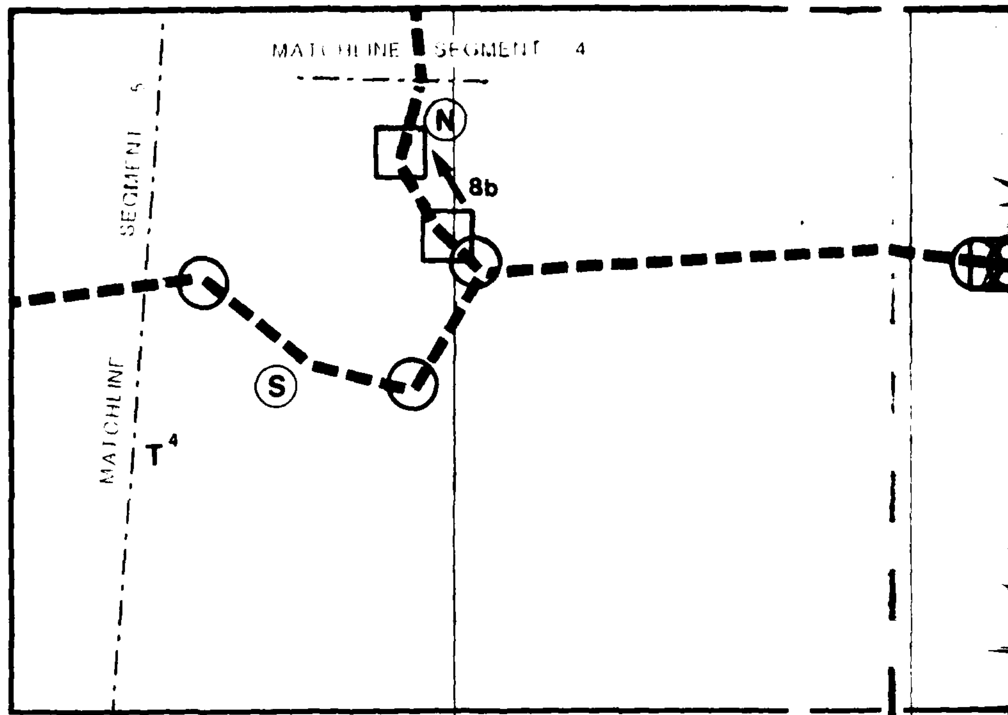
RP 37 RP 36



SEGMENT MAP 10

DEPARTMENT OF WATER RESOURCES

FIG. 6-10

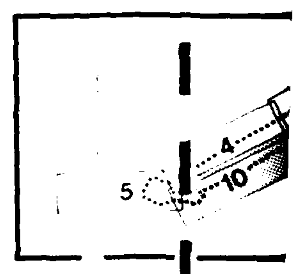


SHEET 10 of 11

PROJECT FEATURES	(N) North Cordelia Forebay Alt. (S) South Cordelia Forebay Alt.		
LAND USE	(N) Residential, vacant (S) Orchard — Grazing Ag.	Orchard Ag.	Irrigated
GEOLOGY/SOILS	(N) Sedimentary rock (S) Bay mud	High salt content	
HYDROLOGY	Suisun Creek (1) stores	High watertable	
VEGETATION/WILDLIFE	(managed) Brackish marsh (1° sensitivity) Salt marsh harvest mouse 4 (probable habitat)	Mixed orchard	
TRAFFIC	Cordelia Rd. S.R. 88		Chadbourne
UTILITIES	36" Water ... 24" sewer (storm)	Prop. sol reserv. ... gas ele. tri.	
SPECIAL FEATURES	(S) Suisun Marsh (1° management area)	Suisun Marsh (2° management area)	
IMPACT SUMMARY	Moderate to high impact area: Suisun Marsh, farmland encumbrance, utilities, farmhouse (N)	Low impact area: farmland encumbrance, partial ...	Low impact ... particul...

RP 39 RP 38

T^5 Threatened, endangered and unique plant and wildlife population (△ - population prior to 1945)	Waterway Crossing
Utility Crossing	Road/Railroad Intersection
A Archaeological Sensitivity	Photographic Reference
Pump Station	Aqueduct/Pipeline
Surge Tower	RP 8 Reference Point
	X Fault Crossing

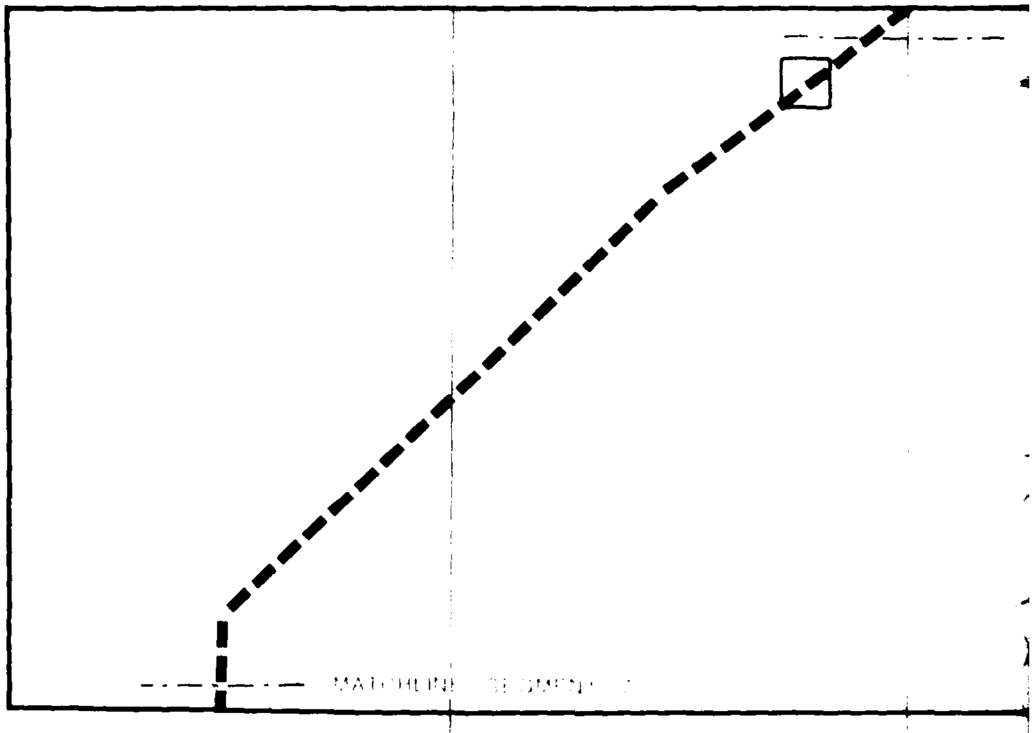


Prepared by ... Associates

N

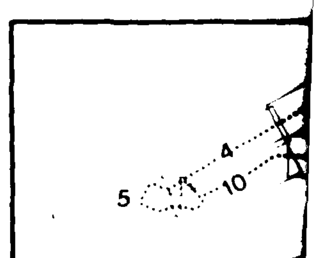
0 — 3000 ft.
0 — 1000 r

SHEET 11 of 11



PROJECT FEATURES		
LAND USE	Travis AFB	
GEOLOGY/SOILS		
HYDROLOGY		
VEGETATION/WILDLIFE		
TRAFFIC		
UTILITIES		
SPECIAL FEATURES		
IMPACT SUMMARY	Low impact area: farmland encumbrance	[illegible]

T[s]	Threatened, endangered and unique plant and wildlife population (Δ - population prior to 1945)		Waterway Crossing
○	Utility Crossing	□	Road/Railroad Intersection
A	Archaeological Sensitivity	←2	Photographic Reference
▲	Pump Station	■ ■ ■	Aqueduct Pipeline
●	Surge Tower	RP 8	Reference Point
		X	Fault Crossing



MATCHLINE SEGMENT 2

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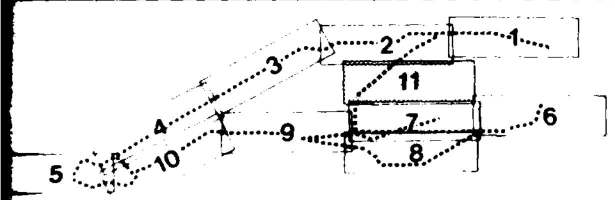


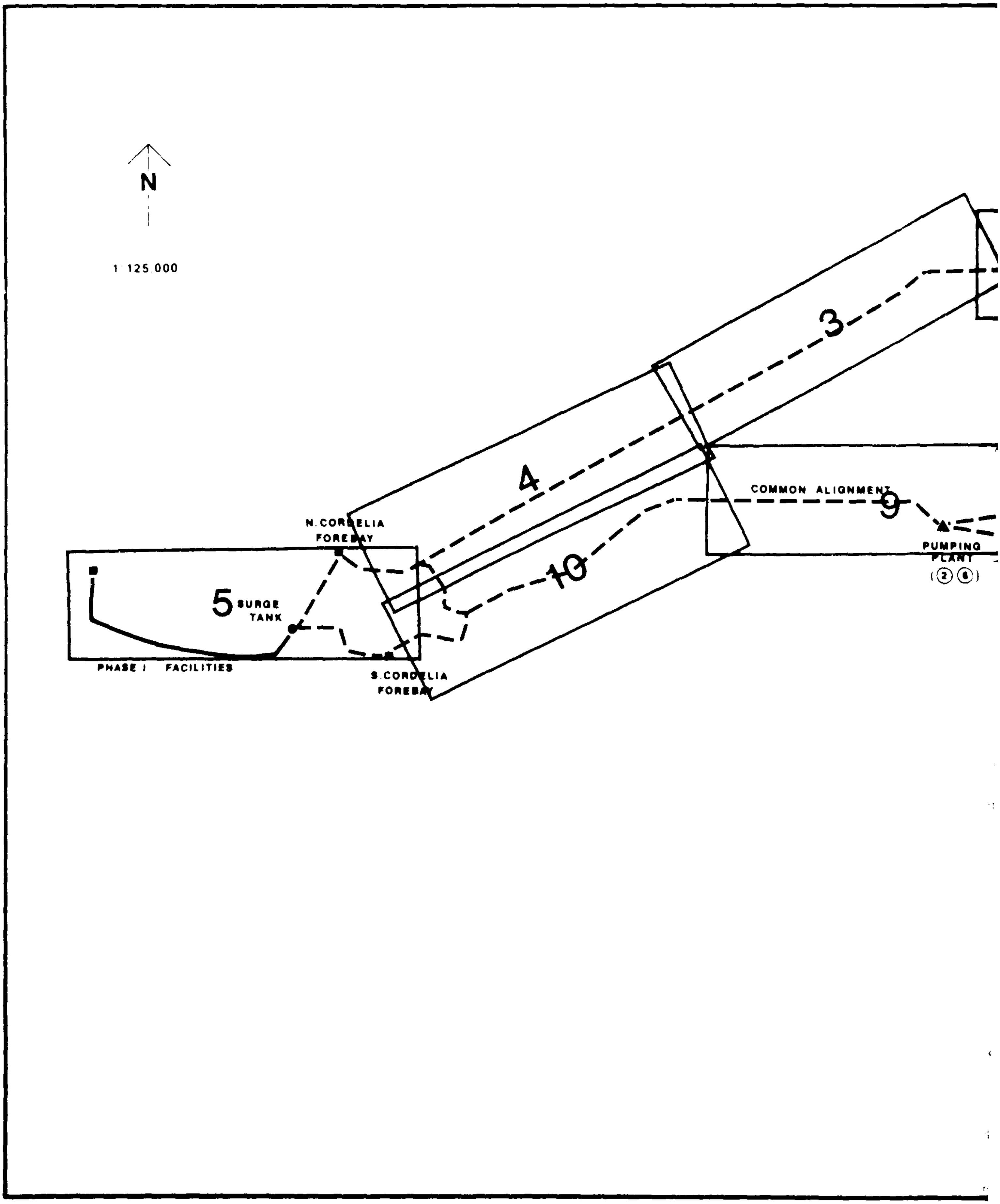
SEE INDEX MAP 6 12

SEGMENT MAP 11

DEPARTMENT OF
WATER RESOURCES

FIG. 6-11

...d by Madrone Associates



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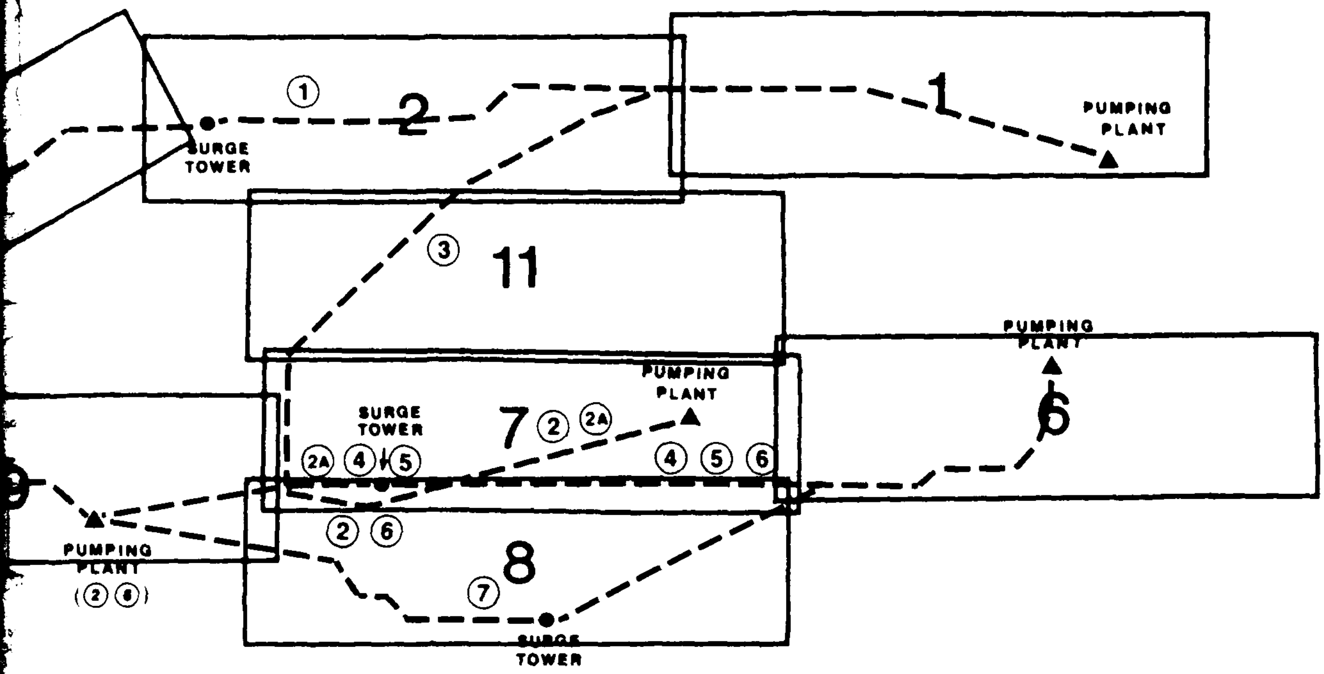


INDEX TO SEGMENT MAPS

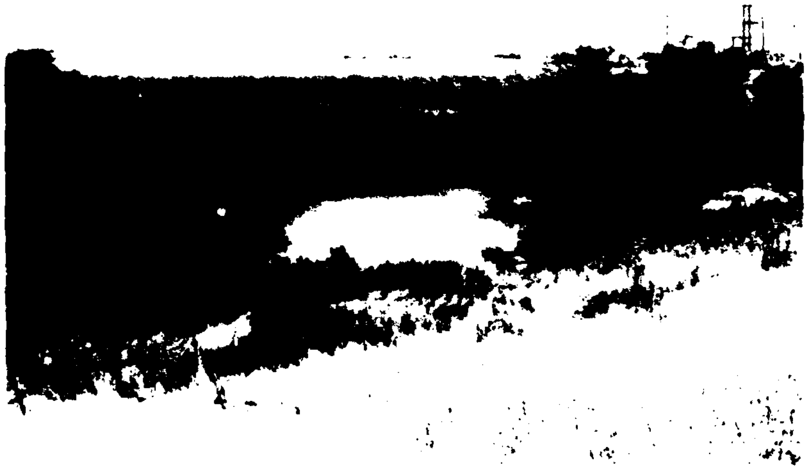
DEPARTMENT OF WATER RESOURCES

FIG. 6-12

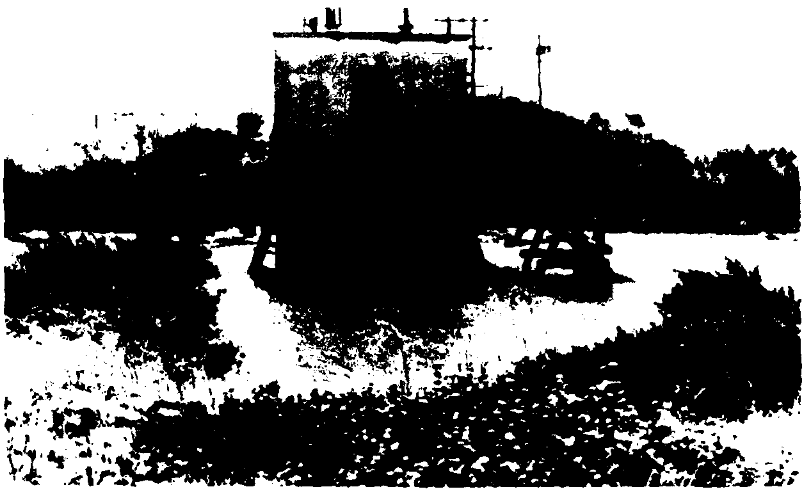
1a. Lindsey Slough intake location looking east.
(See Figure 6-6)

1b. Lindsey Slough intake location looking south.
(See Figure 6-6)

PLATE 1



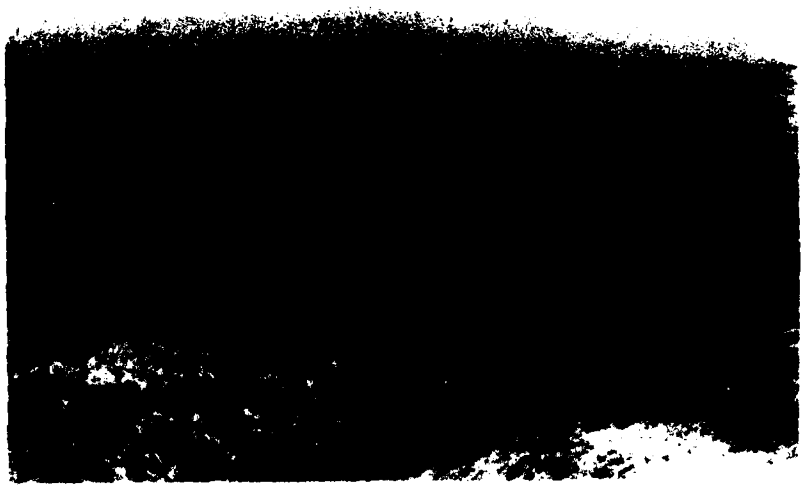
2a. Cache Slough intake location looking south.
(See Figure 6-1)



2b. City of Vallejo intake on Cache Slough looking south.
(See Figure 6-1)

PLATE 2

3a. Calhoun Cut intake location looking east.
(See Figure 6-7)



3b. Jepson Prairie near Calhoun Cut looking west along Routes 2 and 2A. (See Figure 6-7)

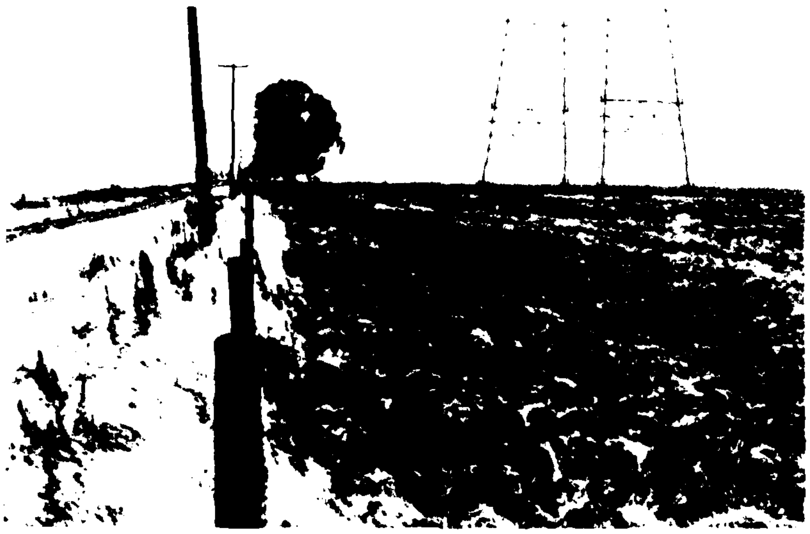
PLATE 3

4a. Vernal pool near alignment for Routes 2 and 2A.
(See Figure 6-7)

4b. Site of proposed Travis pumping plant.
(See Figure 6-9)

PLATE 4

5a. Creed Road looking west along alignments for Routes 4, 5, and 6. (See Figure 6-7)



5b. Creed Road looking east along alignments for Routes 4, 5, and 6. (See Figure 6-7)

PLATE 5

6a. Denverton Creek along Route 7. (See Figure 6-8)

6b. Florida Street in Suisun City along common alignment for Routes 2 through 7. (See Figure 6-10)

PLATE 6

7a. Common alignment for Routes 2 through 7 in Suisun City near Main Street. (See Figure 6-10)

7b. Alignment for Route 1 through Fairfield. (See Figure 6-4)

PLATE 7

8a. Alignment for Route 1 through Fairfield.
(See Figure 6-4)

8b. Common alignment for Routes 2 through 7 to North Cordelia Forebay near Cordelia Hill.
(See Figure 6-10)

PLATE 8

9a. Common alignment for Routes 2 through 7 to South Cordelia Forebay in Suisun Marsh. (See Figure 6-5)

9b. Common alignment for Routes 2 through 7 to South Cordelia Forebay at Cordelia Slough. (See Figure 6-5)

PLATE 9

10a. South Cordelia Forebay location.
(See Figure 6-5)

10b. North Cordelia Forebay location.
(See Figure 6-5)

PLATE 10

vards of dredging while Lindsev Slough would require only about 300 cubic vards of material removed.

6.1.1.1.10 A number of areas along the alternative alignments are sensitive with respect to biological resources. Construction of intake pumping plants and fish-screening structures on either Calhoun Cut, Cache, or Linisev Sloughs would displace and/or disrupt roughly 4 acres of grassland and riparian habitat (Plates 1a, 2a, and 3a). In general the riparian habitat along Lindsev Slough is now the least disturbed of the three intake locations, although the levee on which an intake structure would be constructed is not characterized by extensive riparian vegetation. Associated dredging activities to clear intake channels would further disrupt existing riparian habitat, particularly for a Calhoun Cut intake (Figure 6-7). The impact of dredging and construction on anadromous fish species (e.g., striped bass, king salmon) in the intake sloughs is difficult to predict, since little is known of the extent of these fisheries in the area except for some limited information in Lindsev Slough. It is suspected, however, that Lindsev Slough, with its more extensive shoreline riparian habitat, would be a somewhat more sensitive intake location in this regard.

6.1.1.1.11 It is important to note that a portion of Lindsev Slough (Lindsey Slough marshes) has been designated as "significant natural resource areas" in the 1975 Delta Plan, prepared by the Delta Advisory Planning Council. /2/ Although the construction of an intake and pumping plant on Lindsey Slough in the vicinity of this designated area (Routes 4, 5, 6, and 7) could conflict with this designation, the actual location proposed for the intake is west of the designated area.

6.1.1.1.12 The Delta Master Recreation Plan, prepared in 1976 by the State Resources Agency, developed a "Waterways Use Program" that designated major Delta waterways as either natural, scenic, or multiple-use areas. Calhoun Cut, Barker Slough and Lindsev Slough west of the Peterson Ranch diversion were designated in the program as natural areas which were defined as "those waterways or portions of waterways and abutting lands, including levees, exhibiting scenic, ecological, or natural values of statewide significance".* The program directs that "these areas should be preserved to perpetuate the public trust; to protect wildlife habitat, existing vegetation....; and may be used for nonintensive recreation". A more recent Delta Recreation Concept Plan indicated that Lindsev Slough has recreation use of 47 persons a year. That plan gave no recreation use figures for Calhoun Cut or Barker Slough. /4/

6.1.1.1.13 Lindsev Slough, east of the Peterson Ranch diversion, and Cache Slough, west of its confluence with Haas Slough, have been designated as scenic areas in the program. Scenic areas are defined as "those waterways or portions of waterways and abutting lands including levees which are of lesser ecological or natural value than natural areas or have the potential for enhancement and which can support a wider range of active recreational activities without adverse environmental impact". Cache Slough east of its confluence with Haas Slough has been designated in the waterways program as a multiple-use area which is foreseen to accommodate an even higher intensity of uses than scenic areas.

6.1.1.1.14 To avoid any potential policy conflict arising from a North Bay Aqueduct intake on Lindsev Slough or Calhoun Cut, an alternative intake location has been suggested on the Sacramento Deep

*Statewide significance means the area has such a high environmental value that it could be a candidate for acquisition as a State or Federal Park, preserve, reserve, or wildlife management area. /7/.

Water Ship Channel. /5/ However, the construction of the aqueduct intake at this location would add about 5 miles to the length of the aqueduct, increasing construction costs, energy requirements for pumping, and operation and maintenance. In addition, the confluence of the Ship Channel, Cache Slough, and Miner Slough is considered a prime location for future water-dependent industrial development. /5/ Development of this type near the aqueduct intake could have adverse consequences for water quality.

6.1.1.1.15 Routes 2, 2A, 4, 5, 6, and 7 would cross the Jepson Prairie as defined by the State Parks and Recreation Department (Figures 5-4, 6-7 and 6-8 and Plate 3b). Although the Route 1 alignment skirts the "defined" prairie along the north, a recent vegetation survey indicated that this route crosses areas of relatively undisturbed grassland (see Appendix D). The area contains a number of species of plants and animals which have been officially listed as threatened and endangered, including Solano grass and the Delta green ground beetle. Most of these species are associated with the many vernal pools that cover the area. Construction of an aqueduct across any of these routes would at least temporarily disrupt this existing habitat; however, Route 4 would be less disruptive due to its direct use of Creed Road as a partial right of way. Routes 2 and 2A would pass through a more sensitive portion of the Jepson Prairie (Plates 3a and 3b).

6.1.1.1.16 Another impact associated with an aqueduct traversing the Jepson Prairie and surrounding grasslands would be the potential disturbance to existing domestic grazing animals (i.e., sheep, cattle). Sheep would be expected to be most disturbed by construction activity, particularly during the lambing season (March-April). In addition, construction of an aqueduct along Routes 5 or 6 would necessitate removal of a number of large eucalyptus trees, many of which provide the only significant shade for domestic animals grazing on the surrounding lands.

6.1.1.1.17 All of the alternative alignments to the South Cordelia Forebay, with the exception of Route 1, cross the Suisun Marsh (Plates 9a and 9b). Route 7 to the South Cordelia Forebay would cross the Marsh at two locations. Several threatened and endangered species, including the salt marsh harvest mouse, are either suspected or known to inhabit the Marsh in these areas. Suisun Marsh is also protected by State law, under the jurisdiction of BCDC and the County of Solano (see Section 2.2.2), and has been categorized into primary and secondary management areas. Routes 2 through 6 to the North Cordelia Forebay would avoid the Marsh altogether (see Figure 5-4).

6.1.1.1.18 The project area is prolific with known and recorded cultural resources, particularly archaeological sites. General areas of relatively high archaeological sensitivity that could reveal additional archaeological sites during construction of the aqueduct include portions of the Lindsey Slough shoreline near the proposed intake location, along Route 7 near Denverton Slough, in the Suisun Marsh area surrounding Cordelia Hill, and in Green Valley (Figures 6-5, 6-6, 6-8, 6-10). A possible archaeological site has also been identified in the vicinity of Route 2 north of Creed Road (Figure 6-7). Several historically significant structures are located in the project area, including the Suisun-Fairfield Railroad Station in Suisun City and a small redwood barn in Green Valley (Figures 6-5 and 6-10). Three specific areas of potential conflict with proposed aqueduct alignments and cultural resources have been identified following a detailed investigation (see Section 6.4.1 and Appendix E).

6.1.1.2 Disruption of Social Environment

6.1.1.2.1 Numerous roadways and railroads would have to be traversed during construction of the aqueduct along any of the alignments (Table 6-1). Although many necessary crossings would occur in rural areas or in locations with very low traffic levels, portions of all alternative alignments would also pass through some relatively congested urban areas. Construction of the aqueduct along Route 1 would require the highest number of crossings and would pass through the longest stretch of urban area (Fairfield)(Plates 7b and 8a).

6.1.1.2.2 Even though the pipeline along Route 1 would tunnel underneath major arteries and intersections in Fairfield, construction activities would create some circulation problems requiring temporary rerouting of traffic in certain residential areas (Figures 6-3 and 6-4). Depending on the duration and type of construction, collector streets crossed by the aqueduct would be narrowed to one lane. Construction activity along Route 1 adjacent to Interstate 80 southwest of Fairfield would temporarily affect access at Rockville, Green Valley, and Suisun Valley Roads (Figure 6-4).

6.1.1.2.3 Serious traffic impacts would also be associated with construction of the aqueduct along the common alignment for Route 2 through 7 in Suisun City (Figure 6-10 and Plates 6b and 7a). East of Suisun City, construction activity would affect traffic on Highway 12 both because of material and equipment transport, and because this alignment is parallel to Highway 12 west of Walters Road. Scheduled widening of Highway 12 in this area may immediately precede the period of aqueduct construction. Within Suisun City, Florida Street would be disrupted as would Mulberry, Alder, Cedar, and Main Streets at aqueduct crossing locations. Construction traffic on the local streets in Suisun City would present additional problems. The Highway 12 Fairfield bypass, if completed prior to aqueduct construction, would provide some relief in east-west congestion.

6.1.1.2.4 All alignments would require crossing the Southern Pacific Railroad mainline between the Bay Area and Sacramento. All alignments would also cross the Sacramento Northern line from Sacramento to Collinsville at least once. The Southern Pacific branch line through Cordelia to Napa would be crossed by all alignments to the South Cordelia Forebay. However, construction activity would not be expected to seriously disrupt train traffic.

6.1.1.2.5 In addition to traffic disruption, noise and dust generation would be associated with construction of the aqueduct. The impacts on surrounding areas would be greatest through urban areas, particularly the stretch of Route 1 through Fairfield, where residential neighborhoods, a hospital, rest homes, and other sensitive receptors occur near the proposed right of way (Figure 6-4). People in residences closest to aqueduct construction could be subjected to sporadically high noise levels (up to 78 dBA with open windows). /8/ Construction of the aqueduct along Route 1 through Fairfield could coincide with the development of the proposed linear park system, compounding traffic, noise, and dust impacts (see Section 6.3, Cumulative Environmental Effects). The first phase of park development is currently under construction and is scheduled for completion later this year. DWR plans call for mitigation of any adverse effects on the linear park project. The linear park bikeway could logically be extended easterly to Peabody Road over the buried North Bay Aqueduct.

6.1.1.2.6 Noise and dust generated during aqueduct construction would also disrupt residents of Suisun City in the vicinity of the common pipeline right of way for Routes 2 through 7. However, the length of disruption through this urban area would be considerably less than

that for Route 1. Construction activity associated with the Highway 12 bypass could add to the impact of aqueduct construction and extend the degree of impact on surrounding neighborhoods. Construction near the Suisun Elementary School may cause temporary and sporadic noise increases and possible safety problems to students walking to and from school.

6.1.1.2.7 In rural areas to the east of Fairfield and Suisun City, noise generation could disturb sheep and other domestic animals in the vicinity of construction work but would have little additional effect on the sparsely populated area. Pile-driving activities associated with the construction of pump stations on Cache, Calhoun Cut, or Lindsey Slough would be an especially acute source of noise, with noise levels reaching 106 dBA up to 50 feet from the site. /9/ Dust generation would be most severe along portions of Route 1 east of Fairfield and the common alignment for Routes 2 through 7 west of Suisun City, where the soils contain a relatively high amount of fineparticle silt (Figures 6-2 and 6-10). In addition to dust generation, local air quality would also be temporarily degraded by construction machinery exhaust. Although expected emissions from the machinery would be less than 1 percent of total Solano County vehicular emissions, the diesel fumes could be annoying, particularly where residential areas are close to proposed aqueduct corridors.

6.1.1.2.8 Construction of the aqueduct along the alternative alignments would also require the crossing of numerous utility and service lines. Route 1 construction, with its extensive segment through Fairfield, would encounter a number of minor water and sewer lines and a few relatively major ones (Figure 6-4). A problem with crossing some of these utilities could arise due to the depths they have been placed. /10/ Construction along the common alignment through Suisun City, however, would transect several major utility corridors, including large water and sewer mains, gas lines, and fuel lines (Figure 6-10). There are only limited times of the year when the major gas lines can be shut down for relocation. /11/ In addition, Suisun City is committed to relocate all of these utilities in the near future to coordinate with the construction of the Highway 12 bypass. If this construction precedes that of the aqueduct, these utilities may have to be relocated a second time.

6.1.1.2.9 Other portions of the alignments which could significantly conflict with utility corridors include major gas lines in the eastern portion of project area as well as southeast of Cordelia Hill along the common alignment for Routes 2 through 7 to the North Cordelia Forebay and two large electric towers (230 and 500 KVa) which lie directly in the proposed right of way for Route 6 along Creed Road (Figures 6-7, 6-10 and Plate 5). Paralleling Creed Road in this vicinity are also telephone and electric transmission lines.

6.1.1.3 Commitment of Resources

6.1.1.3.1 Energy and land would be the principal resources committed during construction of the aqueduct. The total energy use required for aqueduct construction along the alternative alignments would range from 1 to 2.5 trillion BTU. The estimate includes both the amount of diesel fuel required to operate construction machinery and the amount of energy required to manufacture the necessary steel and concrete. Construction of the aqueduct along Routes 1, 3, and 7 would generally require more energy due to the longer length of the pipeline needed for this right of way.

6.1.1.3.2 Land would also be consumed during construction of the aqueduct. For pipeline routes, permanent changes in the use of the land would occur only where pump stations or other above-ground

auxiliary facilities are required. On-site disposal of dredged material also consumes a substantial amount of land in the vicinity of intake locations, particularly on Calhoun Cut and Cache Slough. Temporary alteration of land use would occur in an 80-foot wide right of way for a buried pipeline route.

6.1.1.3.3 A commitment of significant resources would occur with an alignment along Routes 2 and 2A. The Nature Conservancy has recently purchased 1,500 acres of the Jepson Prairie in the Dozier area along the Sacramento Northern Railroad line with the intention of maintaining it as an ecological preserve. The property includes part of Calhoun Cut east of the proposed diversion points for Routes 2 and 2A. /12/ Another area immediately to the south and west of the Nature Conservancy property has been under consideration by representatives of the Natural Land and Water Reserve System within the University of California.

6.1.1.3.4 For the open canal routes (2 and 6) a 60-foot wide right of way corridor would constitute a permanent change in existing land use. The presence of an open canal would also permanently separate contiguous farmland and make it more difficult to farm economically. Prime agricultural soils cover extensive areas that would be traversed by the alternative alignments, particularly northeast of Fairfield along Route 1 and west of Suisun City along the common alignment for Routes 2 through 7. To the extent that orchards and vineyards are disrupted during construction of the aqueduct, the impact on agricultural land would be more lasting since at least 5 years would be required for these crops to resume full productivity.

6.1.1.4 <u>Planned Mitigation Measures</u>

6.1.1.4.1 Numerous mitigation measures that could alleviate some of the potential problems discussed above are inherent in or "built into" the construction of an aqueduct. Some of the measures performed as a standard of practice during construction include provisions for special support structures (i.e., piles) for pipeline underlain by bay mud, installation of flexible piping and joints at known earthquake fault crossings, provisions for "blow-off" valves at all waterway crossings, treatment of clayey soils to reduce shrink-swell potential, geological testing of levee stability prior to placement of intake and pump structures, and watering of exposed soils during periods of high winds. Other mitigation features already incorporated into construction planning include placing pipeline entirely underneath streams and waterways and tunneling the aqueduct under major roads and intersections. Construction hours would be modified within urban areas to meet any applicable local noise standards.

6.1.1.4.2 The State Parks and Recreation Department has stipulated that compensation acreage along Routes 2 and 2A and possibly along Routes 4, 5, and 6, if selected, would have to be purchased by the Department of Water Resources to mitigate adverse impacts on the Jepson Prairie (see Section 2.2.5). Were the aqueduct to be built on Route 2 or 2A, Parks and Recreation would request the purchase of at least 3,000 acres of the surrounding Jepson Prairie. Were Route 4, 5, or 6 chosen, Parks and Recreation would require test borings to determine the extent and nature of the underlying claypan layer and, depending on the results of the borings, the purchase of up to 1,000 acres of surrounding prairie might be requested.

6.1.1.5 <u>Possible Mitigation Measures</u>

6.1.1.5.1 In addition to those mitigation features described above and included in current project planning, several other mitigation measures should be incorporated to further reduce the adverse effects associated with aqueduct construction. Alignments to which the

mitigation measures would apply are indicated in parentheses.

° Construction activity in stream areas should employ special erosion control measures to lessen the possibility of increased sedimentation in the streams such as covering storage piles of material, controlling truck movements near creeks to avoid spilling material into the streams, and revegetating graded creek slopes before winter rainfalls. (all)

° Revegetate construction-disturbed areas overlying pipelines or along canal banks as quickly as possible to reduce erosion potential and dust generation. Native vegetation should be employed to the maximum extent practicable. (all)

° Continue to monitor ground water levels in the vernal pool area to be sure the pools would not be adversely affected by a Route 2/2A alignment. (Routes 2 and 2A)

° If a canal is the chosen alternative, consult the Solano County Flood Control and Water Conservation District and the U. S. Army Corps of Engineers to establish a detailed alignment that would not interfere with floods. The canal banks could be used to retain floodwater. (Routes 4 and 6)

° Determine the temporary and permanent impacts of extensive dewatering on the ground water levels. If ground subsidence occurs during the construction, protect any existing structures from damage due to dewatering. Solano County and Suisun City could require the contractor to post a bond for protection of existing structures. (all)

° Along Route 1 within Fairfield, limit construction across traffic corridors to one north-south, and one east-west street at a time, if possible. (Route 1)

° Restore any disrupted segment of the Fairfield Linear Park to its preproject condition and extend linear park bikeway over some of the railroad right of way segments of Route 1.

° Disrupt only one Interstate 80 access road southwest of Fairfield at a time. (all alignments to North Cordelia Forebay)

° Avoid material transportation and street movement of heavy equipment during peak traffic hours. (all)

° Coordinate aqueduct construction along the common alignment for Routes 2 through 7 with Highway 12 improvements between Marina Boulevard and Walters Road in Suisun City. (Routes 2 through 7)

° Construction along the common alignment on Florida Street in Suisun City should be done block-by-block to avoid completely limiting access for longer periods. (Routes 2 through 7)

° Consider tunneling under Main Street to prevent north-south traffic restrictions in Suisun City. (Routes 2 through 7)

° Construction near sensitive agricultural areas should be scheduled during the nongrowing season. (Work during the period immediately following harvest would reduce potential particulates impacts on the crops while avoiding potential erosion problems from heavy rains.)(all)

° Place gravel on temporary access roads to reduce particulate generation near sensitive receptors. (all)

° Cover stock piles of dirt to reduce particulate generation near sensitive areas. (all)

° Intensive construction activities through sheep-grazing lands should be avoided during March and April to minimize disturbance to sheep during lambing season. (Routes 2 through 7)

- Compensation for any displaced riparian habitat, particularly along Calhoun Cut and Lindsey Slough, will be required by the U. S. Fish and Wildlife Service and the California Department of Fish and Game. (all)

- For open canal alternatives, animal escape ramps will be required along fenced areas by U. S. Fish and Wildlife Service and Department of Fish and Game. (Routes 2 and 6)

- Test borings would be required along Creed Road if Routes 4, 5, or 6 are selected to determine the extent and nature of the underlying clay pan layer and to determine the possibility of an adverse effect of aqueduct construction on surrounding vernal pools. (Routes 4, 5 and 6)

- If any archaeological remains are encountered during trench excavation, construction should cease and a registered archaeologist or member of the Solano County Native American Organization consulted. (all)

6.1.2 OPERATIONAL IMPACTS

6.1.2.1 Impacts on Farmland

Operation of the aqueduct would have a few significant effects on agricultural land use. After the pipeline is in place, most agricultural uses would not be affected by its operation. However, repair and maintenance activity could have short-term, localized effects similar to initial construction impacts (see Section 6.1.1.3). Because permanent structures could not be built over the pipeline right of way following aqueduct construction, irrigation and drainage facilities could be constrained in the vicinity of the right of way. This effect could be most significant along the eastern portion of Routes 1 and 3 where more irrigated farming occurs (Figure 6-1).

6.1.2.2 Impacts on Surface and Ground Water Supplies/Quality

6.1.2.2.1 The main impact and, in fact the primary purpose of the North Bay Aqueduct, would be to directly supplement existing surface supplies (and indirectly supplement ground water supplies) in Solano and Napa Counties. Although the Delta water supply would be of substantially lower quality than most existing supply sources, it would still meet current State and Federal safe drinking water standards.

6.1.2.2.2 Several water agencies scheduled to receive North Bay Aqueduct water have expressed concern about the added treatment costs that would be associated with the new supply (see Section 5.8.4). The City of Vallejo has noted a 15 percent higher alum requirement (alum is used to help remove suspended solids from drinking water) in its Travis AFB water treatment plant, which treats only Cache Slough water, compared with its Fleming plant, which treats a blend of Delta water and Lake Berryessa water. /13/

6.1.2.2.3 Water agencies have also expressed concern regarding drinking water quality, particularly with respect to total dissolved solids (TDS), trihalomethanes, and pesticides. Based on limited existing data, water quality appears to be somewhat better in Lindsey Slough as compared with Cache Slough. The data also indicate that water quality in Cache Slough may be deteriorating at a faster rate than in Lindsey Slough (see Appendix C). Still another consideration is the fact that the watershed draining into Cache Slough is characterized by more intensive agriculture and urban development than the Lindsey Slough watershed. Furthermore, projections for future land use indicate that this contrast is likely to increase over the

next 20 years (see Section 5.2.1.3). The City of Vallejo has noted a significant increase in the amount of suspended solids in its existing water supply from Cache Slough. /14/

6.1.2.2.4 The specific impact of the aqueduct on the hydraulics and water quality in intake sloughs during operation has been analyzed with the aid of computer-based numerical models (see Appendix F). Assuming that the net Delta outflow remained the same (i.e., North Bay Aqueduct diversions were compensated for by additional releases to the Sacramento River), water quality in both Cache and Lindsey Sloughs would actually improve slightly during low flow summer periods because better-quality Sacramento River water would be drawn more directly into these areas. Water current velocities in both slough channels would increase in an upstream direction to a slight degree under these same conditions. Average current velocities would be expected to increase more substantially with an intake on Calhoun Cut, due to its more narrow channel configuration.

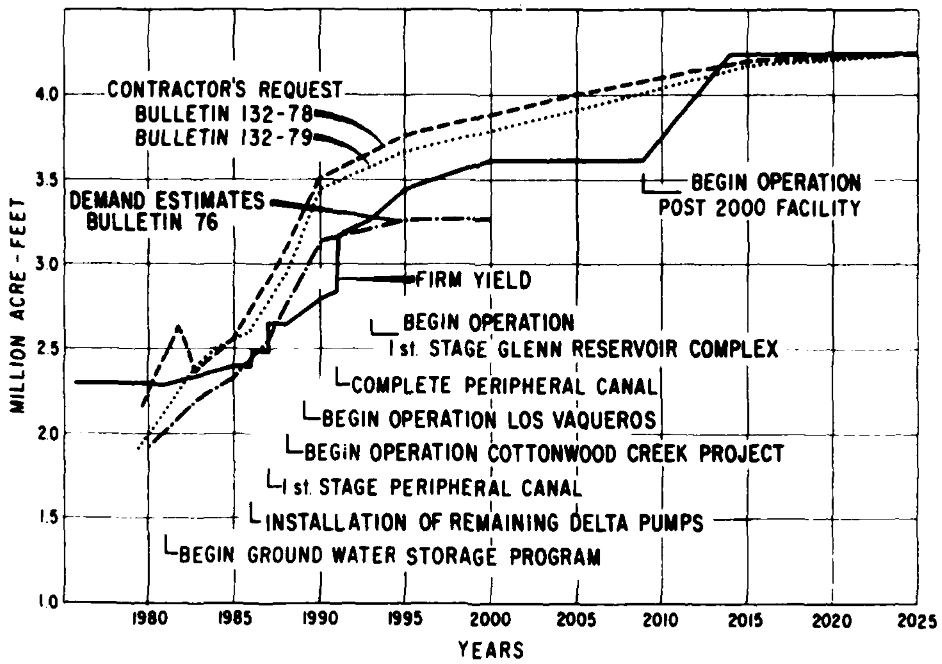
6.1.2.3 Impacts on Delta/State Water Project

6.1.2.3.1 The maximum proposed diversion of 115 cfs for the North Bay Aqueduct would have no signficant effect on net Delta outflow. The water diverted would come from high, excess flows; either by direct diversion in winter when these flows are occurring, or by storage of the excess flow for release and diversion in periods of lower flow.

6.1.2.3.2 The State Water Project operates on a "pool concept". In this context, the North Bay Aqueduct would have the effect of increasing the number of contract users who would share the State Water Project water supply pool. Recent Department of Water Resources projections have indicated that under dry period conditions, the State Water Project would not be able to fully deliver entitlement requests after the early 1980s (Figure 6-13). This inability will be worsened if the NBA is in operation. To fully meet its delivery schedules, the SWP will have to add new facilities to increase project yield. Incremental cost of water from various of the proposed new facilities ranges from about $100 to $600 per acre-foot.

6.1.2.3.3 Two Delta water projects have been proposed in southern Solano County, neither of which would have a noticeable impact on the North Bay Aqueduct. The Suisun Marsh project, the first phase of which has been constructed, involves a plan to reverse the general circulation patterns in Suisun Marsh to help maintain current water quality conditions. In conjunction with this project, the possibility of enlarging the North Bay Aqueduct to provide an additional supply of fresh water to the Marsh has also been considered (see Section 3.3.1.2). PGandE is considering the construction of a coal-fired power plant in Collinsville that would use water from Montezuma Slough. However, this proposal has recently been delayed for at least two years, primarily due to reduced demand for electricity.

6.1.2.3.4 Senate Bill 200, passed by the Legislature and signed by the Governor in 1980, authorizes construction of the Peripheral Canal as part of a comprehensive program of water conservation and augmentation of SWP water supplies. The potential impacts of the operation of the Peripheral Canal were investigated with the aid of DWR's Delta hydraulic model. The Peripheral Canal assumptions used for the model run were based on the critical year flow conditions for August from DWR Bulletin 76. Other flow and boundary conditions were as reported in WRE's study for the State Water Resources Control Board (Appendix C). In addition, the requirement for a minimum flow of 1,000 cfs in the Sacramento River at Rio Vista (Decision 1485) were also assumed in the model run.



Source: DWR Bulletin 139-79, Nov. 1979.

FUTURE SWP SUPPLY AND DEMAND ESTIMATES

FIG. 6-13

The investigation indicates a flow reversal in the lower end of Cache Slough due primarily to high agricultural withdrawals from the upper end of Cache Slough and the Deep Water Channel. However, the requirement to maintain the 1,000 cfs flows at Rio Vista will insure the availability of good-quality water within the region of the North Bay Aqueduct. Consequently, the modeling study does not indicate a significant impact on the hydraulic water quality conditions in the region of the proposed diversion resulting from the operation of the Peripheral Canal.

6.1.2.3.5 In order to guarantee protection of water quality in the Delta under most conditions, DWR has taken several recent actions. The State Water Resources Control Board, through its Water Rights Decision 1485, has established minimum water quality requirements (as measured by salinity) in specified locations throughout the Delta. Based on information provided by DWR, Decision 1485 requires both the State Water Project and the Central Valley Project to maintain minimum flows of 1,000 cfs at Rio Vista. In planning for the State Water Project, DWR has recognized its

responsibility to prevent the degradation of water quality in the area per Decision 1485 and has indicated its full intentions to maintain current water quality standards throughout the Delta. In addition, DWR has negotiated agreements with several Delta water agencies, essentially guaranteeing its water quality during operation of SWP facilities under most conditions. Since D-1485, the Department of Water Resources has signed an agreement (January 1981) with the North Delta Water Agency to assure dependable water supply and suitable quality to Delta water users. The standards established by D-1485 are currently being maintained at Rio Vista. In addition, under operation of the Peripheral Canal, an agreement between DWR and the Department of Fish and Game would require specific flow standards at Rio Vista consistent with the Standards of D-1485.

6.1.2.4 Impacts on Fish and Wildlife

6.1.2.4.1 The principal effect of the diversion for the North Bay Aqueduct on fisheries will be to remove fish and other aquatic organisms along with the water. The proposed placement of fish screens (3/32-inch welded wedge-wire slotted screen) will prevent the larger organisms from being entrained into the aqueduct system. Impingement of larger organisms against the screens could occur; however, the projected approach velocity (not more than half a foot per second) at the intake, should be low enough to enable most fish to swim against the current.

6.1.2.4.2 All king salmon fry, American shad as small as 22 mm, and striped bass as small as 17.6 mm should be excluded from the aqueduct by the screens. /15/ The screens cannot be practically designed to retain any smaller organisms since clogging would occur too rapidly. Many planktonic organisms, including smaller larval fish, fish eggs, and small invertebrates such as the opossum shrimp would readily pass through the screens and into the intake system.

6.1.2.4.3 While the importance of Lindsey Slough as a spawning and nursery ground has not been established, some small fish have been collected there. Even though no specific fish data are available for Cache Slough or Calhoun Cut, it is expected that these waterways would be less important as fishery areas than Lindsey Slough. Lindsey Slough fish samples indicated that a relatively large number of small striped bass fry, a major sport fish in the Delta, would pass through the proposed fish screens.

6.1.2.4.4 Even if aquatic organisms are not taken into the aqueduct system, it is possible that the intake screens will concentrate these organisms in the vicinity of the diversion. Studies conducted at other SWP diversions have shown that predator species tend to concentrate around fish release points and consume more prey items than in normal areas. /16/ The location of the intake on Calhoun Cut could aggravate this problem, since the site is at the end of the slough.

6.1.2.4.5 Periodic maintenance dredging required to keep the intake channels clear would temporarily degrade water quality by stirring up bottom sediments. Although this would be expected to have a relatively minor, short-term adverse effect on local aquatic organisms, the degree of impact would, in part, be related to the frequency and magnitude of required dredging operations.

6.1.2.4.6 The implication of operation of the North Bay Aqueduct on wildlife in eastern Solano County would be minor. However, attraction of wildlife to the aqueduct intake structures would be expected due to the increased concentration of fish species in these locations. Fish release points would also tend to

attract wildlife predators. In the event of an open canal, wildlife could be expected to make use of this additional water habitat.

6.1.2.5 Energy Use

6.1.2.5.1 Electrical power used for pumping water through the aqueduct would reach 15 to 20 million kwh (0.15-0.19) trillion Btu) per year by the year 1990, when use by Solano County is expected to reach full entitlement (see Table 4-1).

This maximum power use is 264-351 Kwh/acre-foot (2.6-3.5 million Btu/acre-foot)(see also Table 5-7). This range is based primarily on overall route length and whether the use of a canal or pipeline is involved. Among alignments proposed entirely as a buried pipeline, Route 1 would require the highest annual energy requirements and Route 2 the lowest. The open canal routes, 2 and 6, would use the least energy during operation because of lower pumping power needs.

6.1.2.5.2 The consumption of electrical power associated with the North Bay Aqueduct would represent about a 0.2 percent increase in the amount presently used for pumping by the State Water Project. Construction energy for the aqueduct, including the energy required to manufacture materials, would be three to eight times greater than the annual operating energy, as shown in Table 6-1. Substantial amounts of energy would also be required if off-site disposal of dredge spoils became necessary, particularly with an intake on Calhoun Cut or Cache Slough.

6.1.2.5.3 About 75 percent of the electrical power used by the project would be consumed by the Cordelia pumping station. Almost all of this power would work against gravity, to lift the water to a surge tank in Napa County. In contrast, the pumping station at the diversion point (or at Travis in the case of Routes 2 and 6) would primarily work against friction. Routes 2 and 6, which would use a canal rather than a pipeline between the diversion point and the Travis pumping plant, would use less energy for pumping. This is primarily because the open V-channel design of the canal would offer less friction and thus require less pumping than a pipeline (see Table 6-1). This advantage is not affected by the reduced energy use which Route 1 would require for the secondary distribution system.

6.1.2.5.4 Pipe sizes for the proposed aqueduct were selected by DWR using the capitalized electrical power cost for pumping derived from a rate of $0.055/kWh in January 1981 with an annual escalation rate of 10 percent and an annual interest rate of 9.5 percent.

6.1.2.5.5 The energy cost associated with the secondary distribution system from the aqueduct to the various water contractors is important. Estimates of energy cost for the secondary distribution system to Vacaville, Fairfield, and Suisun City indicate a substantial savings for Route 1 in comparison to the other more southerly routes (see Table 6-1).

6.1.2.6 Disposal of Dredged Material

6.1.2.6.1 Maintenance dredging to clear intake channels could generate a substantial amount of material requiring disposal. Dredging requirements for an intake on Calhoun Cut (Routes 2 and 2A) would be the greatest because of the required length and dimensions of the channel (Figure 6-7). Cache Slough in the vicinity of the proposed intake for Routes 1 and 3 would also require a significant amount of dredging (Figure 6-1). The existing intake structure for the City of Vallejo on Cache Slough has required increasingly frequent dredging. As a general estimate the frequency of dredging required for the North Bay

TABLE 6-1

ESTIMATED ENERGY USE OF AQUEDUCT AND SECONDARY DISTRIBUTION SYSTEMS IN 1990

(Trillions of Btu)

	Aqueduct	Secondary Distribution	Total
ANNUAL OPERATION			
Electric Pumping			
Route 1	0.19* (19.8 million Kwh)	0.01**	.20
Route 2A	0.16 (16.3 million Kwh)	0.04	.20
Route 2	0.15 (15.3 million Kwh)	0.04	.19
Route 6	0.16 (16.5 million Kwh)	0.04	.20
Routes 3, 4, 5, 7	0.17 (17.6 - 18.3 million Kwh)	0.04	.21
CONSTRUCTION			
Diesel Fuel and Materials			
Route 1	1.0 - 2.5***, +	0.2 - 0.6++	1.2 - 3.1
Routes 2-7	1,0 - 2.5***, +	0.5 - 1.3++	1.5 - 3.8

* Estimates of Kwh supplied by DWR (1 Kwh = 9,700 Btu).
** Based on an assumed cost of 5 cents/Kwh and Table 4-4. Includes Vacaville, Fairfield, and Suisun City.
*** Based on estimates supplied by the DWR.
\+ Estimate of energy costs of manufacturing steel or concrete (CEC, 1979a).
\++ Assumes the same ratio of Btu's to constuction cost as for the project and the cost estimate of Table 4-4.

NOTE: Assumes Routes 2 - 7 to South Cordelia Forebay. Routes 2 - 7 to North Cordelia Forebay would have somewhat higher pumping requirements.

Aqueduct at Cache Slough or Calhoun Cut would be approximately once every 5 years. /17/ Initial dredging requirements for an intake on Lindsey Slough (Routes 4, 5, 6, and 7) would be considerably less than that for Calhoun Cut or Cache Slough (Figure 6-6). It is also probable that dredging frequency would be less on Lindsey Slough, with an estimated frequency of once every 10 years.

6.1.2.6.2 DWR is investigating the possibility of purchasing land adjacent to the proposed intake structures for the storage and drying of dredged material. The amount of area needed for disposal of dredged material would vary considerably, depending on which intake is selected. An intake location on Calhoun Cut would be expected to require a significantly greater amount of land for disposal than an intake on the other sloughs. After drying, the material could be used for dike reinforcement or as a soil amendment. However, it is possible that public health considerations could limit the degree to which the dredged material could be reused.

6.1.2.6.3 If off-site land disposal is required, the nearest certified disposal site would be on the western tip of Grand Island southeast of the intake locations. This disposal site, which would probably be best reached by barge, is approximately 9 miles from the proposed Lindsey Slough intake point, 10.5 miles from the Cache Slough intake point, and 13 miles from the Calhoun Cut intake location. A problem with this site, owned and operated by the Army Corps of Engineers, is that it has uncertain capacity to handle amounts of more than 50,000 cubic yards. /18/ Another disposal site, almost equally distant to the proposed intake locations as the Grand Island site is a site north of Rio Vista owned by the State Reclamation Board. This site has more capacity than the Grand Island site and can be reached by truck. Since the site is controlled by a State agency, this would probably be the preferable off-site land disposal location for North Bay Aqueduct dredged material.

6.1.2.7 Public Safety

6.1.2.7.1 As discussed in Section 5.10, a number of drownings have occurred over the years in the many miles of open water canals in California. These drownings have occurred despite the fact that fencing is typically provided when canals pass through higher-density urban areas. Routes 2 and 6 of the North Bay Aqueduct, which would include open canals from the intake location to the Travis pumping plant, would be fenced along their entire length. Nevertheless, some people would undoubtedly find their way into the open canal segments, and a few of these might drown (perhaps one drowning every 3 or 4 years).

6.1.2.7.2 The buried pipeline segments of alternative alignments would present little public hazard during operation. However, above-ground structures associated with the pipeline (i.e., blow-off pipes) could be a safety hazard for children attempting to climb them. This would be a more significant problem in urban areas, particularly through Fairfield, where the linear park system along the abandoned Northern Sacramento right of way seems certain to attract large numbers of school-aged children.

6.1.2.8 Aesthetics

Once construction has been completed, the visual consequences of the aqueduct would be minimal. Major above-ground structures, including pumping plants, terminal reservoirs and the surge towers would be located in the more sparsely populated rural portions of Solano County. The Travis pumping plant and the 40-foot high surge tower along Creed Road would be visible to travelers along Highway 12. The proposed intake locations are isolated and would not constitute a visual intrusion to most County residents.

6.1.2.9 Planned Mitigation Measures

6.1.2.9.1 Mitigation features inherent in current aqueduct operation plans have been mentioned in the preceding sections. To insure the beneficial effect on intake slough water quality predicted by modeling studies, DWR is committed to provide for additional upstream releases from the SWP to compensate for North Bay Aqueduct withdrawals. Any potential impacts on total Delta outflow would also be reduced by this operating procedure. In addition, potential adverse consequences of the proposed Peripheral Canal would be further alleviated by water quality agreements among DWR and various Delta water agencies.

6.1.2.9.2 To minimize any damage to fisheries in the intake sloughs, fish screens would be provided. The fish screens have been designed with a relatively fine mesh size and low approach velocity to minimize entrainment and impingement of aquatic organisms.

6.1.2.9.3 Impacts associated with the disposal of dredged material could be significantly reduced if on-site disposal to store, dry, and recycle the material is achieved. However, the amount of dredging required for Calhoun Cut would probably make on-site disposal unacceptable because of the amount of private land which would have to be purchased and the implications on the Jepson Prairie.

6.1.2.10 Other Mitigation Measures

In addition to those mitigation features already included in current planning, several other mitigation measures will be considered during operation of the aqueduct to minimize any adverse environmental effects.

- Annual crops will be considered for right of way replanting following aqueduct construction to minimize future maintenance conflicts.

- Studies will be conducted in the slough finally selected as the diversion point to obtain specific baseline information on fish spawning areas and nursery grounds and their sensitivity to the diversion.

- An investigation could be conducted of the overall cost effectiveness of developing storage facilities for aqueduct water in order to minimize the use of power for pumping during the hours of peak electricity demand. For open canal Routes 2 and 6, the peak hour electricity use of the diversion point pumping station may be reduced by utilizing the top foot of the 5-foot deep canal as storage. The top foot of the canal would store about 15 acre-feet compared to the average hourly flow of water through the aqueduct at full entitlement of about 6.5 acre-feet.

- Prior to 1990, when the aqueduct would be operating below capacity, the diversion point pumping station should be operated primarily during the hours of high tide to reduce the elevation the water must be pumped into the canal and minimize energy consumption.

- Conduct comprehensive water quality studies (i.e., inorganic and organic chemicals) in Cache and Lindsey Sloughs in the vicinity of the proposed intake locations to fully determine comparative suitability as a current and future drinking water source. Organic chemical levels and sediment loadings should be parameters of particular concern.*

*DWR has recently indicated an intention to conduct a one-year water quality sampling program in several locations of Cache and Lindsey Sloughs. /18/

6.2 SECONDARY ENVIRONMENTAL EFFECTS

6.2.1 RELATIONSHIP OF WATER SUPPLY TO POPULATION GROWTH

6.2.1.1 The provision of additional water supply in an area where it would eventually become limited can have a direct effect on population growth. If economic conditions are favorable, removal of the water supply constraint by developing new sources of supply or significantly reducing demand would permit additional population growth. The degree of this population growth would depend on a variety of local and regional factors, particularly local attitudes, policies, or regulations regarding growth management.

6.2.1.2 The magnitude of the effect on population growth of an increment to water supply depends on the level of demand for residency in the area that receives the new supply and the presence or lack of other controlling factors, such as land availability, dwelling unit vacancy rate, availability of sewer service, and the growth policies of local government.

6.2.1.3 Napa County and some of its incorporated cities have growth management policies that could temper any impetus the North Bay Aqueduct might give to population growth. A ballot initiative approved by Napa County voters in November 1980 requires the Board of Supervisors to adopt a growth management system no later than August 1981. Under this system, which derives from the county general plan, growth would be limited to a rate comparable to the rate of increase in other Bay area counties, or 1 percent annually, whichever is lower. However, the City of Napa recently removed residential development controls.

6.2.1.4 In Solano County, adopted general plans also project a desired level of growth which, in general, is controlled less rigidly than in Napa County. These plans assume, among other things, the availability of future North Bay Aqueduct water supply. Limitations on discharge of sewage treatment plant effluent may affect the outlook for growth in Solano County, but local officials are working on this problem, and a solution satisfactory to the Regional Water Quality Control Board may be expected.

6.2.2 ENVIRONMENTAL CONSEQUENCES OF GROWTH

6.2.2.1 Population growth inevitably affects the environment. Congested roads, dirtier air, more noise, and strains on public services may be expected. The extent to which these problems are anticipated largely determines the severity of their overall impact.

6.2.2.2 Environmental effects of growth may be placed in three categories. In the first category, impacts would be generally proportional to growth. These types of impacts would include exposure to seismic hazards, energy and land consumption, total vehicle miles traveled, regional air quality degradation, and most social and economic factors (e.g., construction industry stimulation).

In the second category, impacts would be proportional to population growth which occurs only in certain areas. Among these impacts would be exposure to flooding hazards, conversion of prime agricultural soils, and many ecological effects. In the final category, effects would be entirely site-specific, such as archaeological resources and threatened and endangered species.

6.2.2.3 In Solano County projected population growth would largely center in the incorporated jurisdictions of Suisun City, Fairfield (including Cordelia) and Vacaville. Additional population in these areas would substantially increase traffic congestion (particularly prior to completion of the Highway 12 Bypass), elevate ambient noise levels throughout the area, and generally diminish the open space and wildlife values of lands now comprising the urban fringe. Development in Suisun City would also put additional pressure on the adjacent Suisun Marsh, although recent establishment of the Marsh as a preserve should provide substantial buffering and protection. Urban expansion projected for Cordelia and Green Valley is likely to conflict with the archaeological sensitivity of the area. In the era of budget limitations, public services in this area, particularly schools, would have to struggle even more vigorously to keep pace with increasing demand.

6.2.2.4 Where additional development would occur in northeast Fairfield and western Suisun City, some prime agricultural land would be tak n out of cultivation. The loss of prime agricultural land by urban encroachment has become an increasingly critical issue in California and throughout the nation. Local regulatory mechanisms to control prime agricultural land conversion in Solano County are limited. The extent to which prime agricultural soils will be permanently lost to urban development over the next 20 years in the County will depend on a variety of factors, including local economics, other developmental constraints, and the presence of any additional regulatory controls.

6.2.2.5 In Napa County, although problems similar to those discussed above will be apparent, population growth is projected to continue at much more modest levels. Existing local growth control ordinances and land use restrictions (e.g., establishment of an agricultural preserve) should enable a more easily managed scenario of environmental change.

6.2.3 GROWTH INDUCEMENT ATTRIBUTABLE TO THE PROPOSED ACTION

6.2.3.1 The purpose of building the North Bay Aqueduct would be to supply municipal and industrial water to meet demands that are expected to develop in Solano and Napa Counties due to growth in the population and economy there. Whether the added water supply would include, enable or merely facilitate such growth depends on point of view.

6.2.3.2 With the maximum North Bay Aqueduct supply of 42,000 acre-feet per year, urban growth in fulfillment of current projections for Solano County (Table 6-2) would not be constrained. At the per capita use rate implied by the demand estimates in Table 6-[illegible] 0.143 ac-ft per person per year [illegible] the additional 42,000 ac-ft of water could support a population increase of about 293,000 people, which is close to the increase projected for the period 1980 to 2020.

6.2.3.3 The North Bay Aqueduct supply also would support projected growth in Napa County. Applying the per capita use rate implied by [illegible] 0.186 ac-ft per person pear [illegible] the net new water supply provided by the North Bay Aqueduct ([illegible],500 ac-ft) gives an indication that the additional water could support a population increase of about 94,000 people, which is close to the increase projected for the period 1980 to 2020.

6.2.3.4 Lack of water would retard growth that would otherwise occur, provided water is more available in alternative locations. With the present population and level of industrial development, the existing water supplies for Solano and Napa are already spread relatively thin compared to other areas in California; so without a new supply, water could become a factor controlling growth, probably by the mid-1980s.

6.2.3.5 It should be noted that operation of the North Bay Aqueduct at its

TABLE 6-2

REVISED E-150* POPULATION PROJECTIONS
FOR SOLANO AND NAPA COUNTIES, ADJUSTED FOR 1980 CENSUS

	1980	1990	2000	2010	2020
Solano County					
Non-Military	219,900	296,400	375,700	462,400	550,500
Military	13,400	13,400	13,400	13,400	13,400
Total	233,300	309,100	389,100	475,800	563,900
Napa County					
Total	96,700	117,900	143,200	167,400	192,400
Both Counties					
Total	330,000	427,000	532,300	643,200	756,300

*Source: State Department of Finance

maximum physical capacity could result in a theoretical maximum total water supply of about 76,000 acre-feet/year. This means that it is hypothetically possible that an additional 13,500 acre-feet of water could be made available to Napa and/or Solano Counties. Such a circumstance would enable support of a greater number of persons. However, this situation is only hypothetical and would be tempered by existing regulatory constraints as well as actual operational limitations.

6.3 CUMULATIVE ENVIRONMENTAL EFFECTS

6.3.1 Several major proposed or in-progress public works projects in Solano County could interact with and compound the environmental effects of North Bay Aqueduct construction and operation. These projects would include the City of Vacaville's plans to relocate its existing waste water discharge, the Highway 12 bypass project, and the City of Fairfield's Linear Park.

6.3.2 The City of Vacaville has expressed concern over possible conflicts between its sewage treatment and disposal facilities and the North Bay Aqueduct. Vacaville's existing sewage discharge in Alamo Creek, a tributary to Cache Slough, was ordered by the State to be removed unless expensive improvements to the treatment plant are undertaken. The removal order followed concern by the City of Vallejo, which has an existing drinking water intake on Cache Slough, over degradation of water quality due, in part, to the upstream sewage discharge. The most cost-effective solution to the problem for Vacaville would be to relocate its discharge to Barker Slough, a tributary to Lindsey Slough. Vacaville would consequently prefer that the North Bay Aqueduct have its intake on Cache Slough to avoid any future conflicts with its sewage disposal. /23/

6.3.3 Construction on the long-planned Highway 12 bypass through the redevelopment area of Fairfield has recently begun. Potential construction conflicts with the North Bay Aqueduct (Routes 2 through 7) and the bypass would include disruption to recently relocated major utility lines and compounding or extending the period of general construction impacts.

6.3.4 The construction of Fairfield's Linear Park system has also begun, with Phase I from the Solano Mall to the Community College currently being developed. Phases II and III of the park system over the remaining stretches of the old abandoned Northern Sacramento Railroad right of way are scheduled to be completed in the next few years. Construction of the North Bay Aqueduct along Route 1 would disrupt the Phase I segment of the Linear Park and possibly Phases II and III, with the consequence of extending and/or compounding the noise, dust, and other impacts on adjacent neighborhoods (see Section 6.1.1.2).

6.3.5 The North Bay Aqueduct diversion would add to the already complex problem of water quality management in the Delta, and it would increase the number of people dependent on water supply from the Delta. DWR must manage all its facilities affecting the Delta to meet the water quality standards of the State Water Resources Control Board.

6.3.6 The Corps of Engineers is planning to deepen the deep water ship channels to Sacramento and Stockton. Neither project would have a significant effect on water currents in the vicinity of the prospective North Bay Aqueduct diversion points.

6.4 SUMMARY OF ENVIRONMENTAL EFFECTS: ALTERNATIVE ALIGNMENT ANALYSIS

6.4.1 An overview of the expected environmental effects along the alignment corridors, and their relative magnitude, is presented in Table 6-3. In many instances there would be substantial differences between the alternative

TABLE 6-3

ALTERNATIVE ALIGNMENTS: ENVIRONMENTAL IMPACT AND/OR CONSTRAINTS MATRIX

IMPACT/CONSTRAINT	ALIGNMENT 1	2	2A	3	4	5	6	7
Geologic hazard along alignment corridor C/O	moderately low (seismic, liquefaction)	moderately high (seismic, bay mud, liquefaction) *moderate	moderately high (seismic, bay mud, liquefaction) *moderate	moderately high (seismic, bay mud, liquefaction) *moderate	moderately high (seismic, bay mud, liquefaction) *moderate	moderately high (seismic, bay mud, liquefaction) *moderate	moderately high (seismic, bay mud, liquefaction) *moderate	moderately high (seismic, bay mud, liquefaction)
Flooding potential along alignment corridor C/O	moderately low	moderate *moderately low	moderately high *moderate	moderate *moderately low	moderate *moderately low	moderate *moderately low	moderately high *moderate	moderate *moderately low
Stream crossings along alignment corridor C	high (Ulatis, Alamo, Laurel, Ledgewood, McCoy, Suisun, Cordelia) - one perennial	moderate (Denverton, Union, McCoy, Ledgewood, Laurel, Suisun, Cordelia) - one perennial	moderate (Denverton, Union, Ledgewood, McCoy, Laurel, Suisun, Cordelia) - one perennial	low (Ulatis, Alamo, Union, Laurel, Ledgewood, Suisun, Cordelia, McCoy) - one perennial	moderate (Big Ditch, Denverton, Union, Laurel, Ledgewood, McCoy, Suisun, Cordelia) - one perennial	moderate (Big Ditch, Denverton, Union, Laurel, Ledgewood, McCoy, Suisun, Cordelia) - one perennial	moderate (Big Ditch, Denverton, Union, Laurel, Ledgewood, McCoy, Suisun, Cordelia) - one perennial	high (Big Ditch, Denverton Slough, Union, Laurel, Ledgewood, McCoy, Suisun, Cordelia) two perennials one slough
Diversion effects on intake slough hydraulics O	low	moderate	moderate	low	moderately low	moderately low	moderately	moderately low
Diversion effects on intake slough water quality (beneficial) O	low	moderately low	moderately low	low	moderately low	moderately low	moderately low	moderately low
Diversion effect on net Delta outflow O	none	none	none	none	none	none	none	none

* Unique to North Cordelia Forebay alternate route (Routes 2 - 7)

NOTE: Construction (C) or operational (O) impact indicated in lower right corner.

	ALIGNMENT							
IMPACT/CONSTRAINT	1	2	2A	3	4	5	6	7
Diversion effect on local anadromous fish O	low	moderately low	moderately low	low	moderate	moderate	moderate	moderate
Unique ecological communities in vicinity of alignment corridor C	moderately low (Jepson Prairie, vernal pools)	high (Jepson Prairie, vernal pools) high (riparian)	high (Jepson Prairie, vernal pools) high (riparian)	moderately low (Jepson Prairie, vernal pools) moderate (riparian)	low (Jepson Prairie, vernal pools) moderate (riparian)	moderate (Jepson Prairie) low (vernal pools) moderate (riparian)	moderate (Jepson Prairie) low (vernal pools) moderate (riparian)	moderately high (Jepson Prairie) moderate (vernal pools) moderate (riparian)
Endargered species in vicinity of aligrment corridor C	moderately low	high	high	moderate	moderately low	moderate	moderate	moderate
Encroachment in Suisun Marsh C	none	moderate (primary and secondary management areas) *none	moderate (primary and secondary management areas) *none	moderate (primary and secondary management areas) *none	moderate (primary and secondary management areas) *none	moderate (primary and secondary management areas) *none	moderate (primary and secondarey management areas) *none	high (primary and secondary management areas) *moderate
Intake slough initial dredging requirements C	moderate (30,000 cubic yards)	high (168,000 cubic yards)	high (168,000 cubic yards)	moderate (30,000 cubic yards)	low (300 cubic yards)	low (300 cubic yards)	low (300 cubic yards)	low (300 cubic yards)
Frequency of intake slough maintenance dredging O	high (every five years or after "significantly above normal" rainfall seasons	high (every five years)	high (every five years)	high (every five years or after "significantly above normal" railfall seasons)	low (every ten years)	low (every ten years)	low (every ten years)	low (every ten years)

* Unicue to North Cordelia Forebay alternate route (Routes 2 - 7)

NOTE: Construction (C) or operational (O) impact indicated in lower right corner.

IMPACT/CONSTRAINT	ALIGNMENT 1	2	2A	3	4	5	6	7
Archaeological sensitivity along alignment corridor C	moderately low	moderately high *high	moderately high *high	moderate *moderately high	moderately low *moderate	moderate *moderately high	moderate *moderately high	moderately high
Encroachment/ encumberance of farmland C/O	moderately high (irrigated crops, some pasture, orchards, vineyards)	high (pasture, orchard) - permanent easement	moderate (pasture, orchard)	moderately high (pasture, irrigated crops, orchard)	moderately low (pasture, orchard, some irrigated crops)	moderate (pasture, orchard, some irrigated crops)	high (pasture, orchard, some irrigated crops) - permanent easement	moderate (pasture, orchard, some irrigated crops)
Roadway crossings along alignment corridor C	High (10 urban, 1 freeway)	moderate (5 urban, 3 freeway) * (5 urban, 2 freeway)	moderate (5 urban, 3 freeway) * (5 urban, 2 freeway)	moderate (5 urban, 3 freeway) * (5 urban, 2 freeway)	moderate (5 urban, 3 freeway) * (5 urban, 2 freeway)	moderate (5 urban, 3 freeway) * (5 urban, 2 freeway)	moderate (5 urban, 3 freeway) * (5 urban, 2 freeway)	high (5 urban, 5 freeway) * (5 urban, 4 freeway)
Traffic disruption in vicinity of alignment corridor C	high (Pennsylvania Ave., Dover Ave., N. Texas St., Air Base Parkway in Fairfield)	moderately low (Hwy 12, Florida and Main Streets in Suisun; Rockville, Suisun Valley, Green Valley Roads)	moderately low (Hwy 12, Florida and Main Streets in Suisun; Rockville, Suisun Valley, Green Valley Roads)	moderately low (Hwy 12, Florida and Main Streets in Suisun; Rockville, Suisun Valley, Green Valley Roads)	moderate (Creed Road; Hwy 12, Florida and Main Streets in Suisun; Rockville, Suisun Valley, Green Valley Roads)	moderately low (Hwy 12, Florida and Main Streets in Suisun; Rockville, Suisun Valley, Green Valley Roads)	moderately low (Hwy 12, Florida and Main Streets in Suisun; Rockville, Suisun Valley, Green Valley Roads)	moderately high (Hwy 12 [3X], Florida and Main Streets in Suisun; Rockville, Suisun Valley, Green Valley Roads)
Railroad crossings along alignment corridor C	high (Sacramento Northern, Southern Pacific)	moderate (Southern Pacific) *moderately high (Southern Pacific, Sacramento Northern)	moderate (Southern Pacific) *moderately high (Southern Pacific, Sacramento Northern)	moderate (Southern Pacific) *moderately high (Southern Pacific, Sacramento Northern)	moderate (Southern Pacific) *moderately high (Southern Pacific, Sacramento Northern)	moderate (Southern Pacific) *moderately high (Southern Pacific, Sacramento Northern)	moderate (Southern Pacific) *moderately high (Southern Pacific, Sacramento Northern)	moderate (Southern Pacific) *moderately high (Southern Pacific, Sacramento Northern)
Noise/dust sensitivity along alignment corridor C	high (hospital rest home, residential Fairfield)	moderate (elementary school, downtown Suisun City)	moderate (elementary school, downtown Suisun City)	moderate (elementary school, downtown Suisun City)	moderate (elementary school, downtown Suisun City)	moderate (elementary school, downtown Suisun City)	moderate (elementary school, downtown Suisun City)	moderate (elementary school, downtown Suisun City)

* Unique to North Cordelia Forebay alternate route (Routes 2 - 7)

NOTE: Construction (C) or operational (O) impact indicated in lower right corner.

IMPACT/CONSTRAINT	ALIGNMENT 1	2	2A	3	4	5	6	7
Utility conflicts along alignment corridor C	moderate (numerous water, sewer through Fairfield)	moderately high (major water, sewer, gas through Suisun City)	moderately high (major water, sewer, gas through Suisun City)	moderately high (major water, sewer, gas through Suisun City)	moderately high (major water, sewer, gas through Suisun City)	high (major water, sewer, gas through Suisun City; electric transmission along Creed Rd.)	high (major water, sewer, gas through Suisun City; electric transmission along Creed Rd.)	moderately high (major water, sewer, gas through Suisun City)
Conflict with Vacaville wastewater discharge relocation O	low	high (possible Barker Slough discharge)	high (possible Barker Slough discharge)	low	high (possible Barker Slough discharge)	high (possible Barker Slough discharge)	high (possible Barker Slough discharge)	high (possible Barker Slough discharge)
Public safety hazard C/O	moderately low (long distance through urban area)	moderate (open canal drowning hazard)	low (shorter distance through urban area)	low (shorter distance through urban area)	low (shorter distance through urban area)	low (shorter distance through urban area)	moderate (open canal downing hazard)	low (shorter distance through urban area)
Regulatory and jurisdictional involvement along alignment corridor C	moderately high	high *moderately high	high *moderately high	moderately high *moderate	moderate *moderately low	moderately high *moderate	moderately high *moderate	high
Aqueduct construction costs (1980 dollars)	$42.3 million	$25.7 million	$31.6 million	$43.6 million	$38.8 million	$38.8 million	$31.6 million	$39.7 million
Secondary water transport system construction costs	$[illegible] million	$17.3 million	$17.3 million	$17.3 million	$17.3 million	$17.3 million	$17.3 million	$17.3 million

* Unique to North Cordelia Forebay alternate route (Routes 2, 2A)

NOTE: Construction (C) or operational (O) impact indicated in lower right corner

IMPACT/CONSTRAINT	ALIGNMENT 1	2	2A	3	4	5	6	7
Total construction costs C	$49.4 million	$42.9 million	$48.9 million	$60.8 million	$56.0 million	$56.0 million	$48.8 million	$56.9 million
Annual operation and maintenance cost at maximum entitlement O	$1.5 million	$1.1 million	$1.2 million	$1.3 million	$1.3 million	$1.3 million	$1.2 million	$1.3 million
Annual energy requirements at maximum entitlement** O	19,816 mwh	15,314 mwh	16,260 mwh	18,253 mwh	17,579 mwh	17,584 mwh	16,493 mwh	17,748 mwh
Conflict with 1975 Delta Plan designation of "significant natural resource area" C/O	low ("scenic area")	high ("natural area")	high ("natural area")	low ("scenic area")	low ("scenic area")	low ("scenic area")	low ("scenic area")	low ("scenic area")
Water quality of aqueduct supply	moderately low (slightly higher TDS, Cl; urban runoff, irrigation returns)	unknown	unknown	moderately low (slightly higher TDS, Cl; urban runoff, irrigation returns)	moderate (some irrigation returns)	moderate (some irrigation returns)	moderate (some irrigation returns)	moderate (some irrigation returns)

* Unique to North Cordelia Forebay alternate route (Routes 2 - 7)

**Computed on monthly distribution of maximum entitlement

NOTE: Construction (C) or operational (O) impact indicated in lower right corner.

alignments as to the degree of environmental impact anticipated.

6.4.2 Geologic hazard and flooding potential would not be substantially different between the possible alignments. However, alignments which avoided traversing areas underlain by bay mud (Route 1 and the North Cordelia Forebay alternative for Routes 2 through 6) would require less expensive construction techniques and would be generally less susceptible to seismic hazards.

6.4.3 All of the alternative alignments would require numerous stream and slough crossings, although most streams are dry during a good part of the year. Routes 1 and 7 would require the most crossings with the latter alignment intersecting two perennial streams and the upper reaches of one slough. The common alignment for Routes 2 through 7 to the South Cordelia Forebay would require the crossing of Cordelia Slough in the primary management area of the Suisun Marsh (Plate 9b). The common alignment through Suisun City (Routes 2 through 7) would also cross an approximately 20-foot deep channel near Florida Street in the eastern portion of the City.

6.4.4 The alternative alignments for Routes 2 and 2A have the greatest potential for disturbance to the Jepson Prairie. The Prairie in the vicinity of the proposed intake for these two routes is in a more natural state than other potential aqueduct locations farther south (Routes 4, 5, and 6). Construction of the aqueduct in this area would have a highly significant impact because of the extensive modifications required for Calhoun Cut and because additional access roads would have to be built to allow construction and maintenance vehicles to reach the area. The alignments for Routes 4, 5, and 6 along Creed Road would not impact the Jepson Prairie to the extent that Routes 2 and 2A would because an access road is already provided (Creed Road) and the area has already been somewhat disturbed. Although Routes 1 and 3 to the north were originally designed to avoid the defined Jepson Prairie, they actually traverse significant areas of native grassland (see Appendix D).

6.4.5 The effects of the aqueduct diversion on intake slough hydraulics and water quality would be slight and in the case of water quality would be beneficial (see Appendix F).

6.4.6 Although the significance of the aqueduct diversion on the entrainment and/or impingement of anadromous fish using the intake slough is difficult to quantify because of limited data on current fish usage, it would be expected that Lindsey Slough would be slightly more sensitive to this effect (see Section 6.1.2.4). Routes 2 and 2A would be the most highly sensitive to the disturbance of unique ecological communities in Solano County, particularly if the alternative route to South Cordelia Forebay through Suisun Marsh is considered. The Jepson Prairie and Suisun Marsh would be the ecological communities of most importance. Sensitivity to the possible presence of endangered or threatened species would also be highest for Routes 2 and 2A. Results of a biological assessment to determine the range and distribution of unique plant and animal species in the vicinity of the proposed alignments are attached as Appendix D.

6.4.7 Estimated initial dredging requirements indicate that constructing an intake on Calhoun Cut (Routes 2 and 2A) would require the most extensive excavation. Approximately 168,000 cubic yards of material along an approximate 3-mile reach would have to be dredged to accommodate an intake at this location.

An intake on Cache Slough (Routes 1 and 3) would also require a substantial amount of initial dredging (30,000 cubic yards along a 1/2 mile distance) but significantly less than that for Calhoun Cut. An intake on Lindsey Slough (Routes 4, 5, 6, and 7) would require a relatively nominal amount of initial

dredging (300 cubic yards). Disposal of dredge spoils would be a significant concern and, if on-site disposal is desired, could have substantial additional acreage requirements at the intake locations. Maintenance dredging requirements, both in frequency and quantity, would also be expected to be higher for Calhoun Cut and Cache Slough than for Lindsey Slough.

6.4.8 Preliminary field reconnaissance and literature review indicates that Routes 2 and 2A are the most highly sensitive to the possible presence of archaeological and other cultural resources. Routes 2 through 7 to the South Cordelia Forebay are almost equally sensitive. Route 1 is somewhat less sensitive with regard to these resources. A detailed archaeological survey of several of the alternative alignments (Routes 1, 4, and 6) is presented in Appendix E. This survey revealed that Routes 4 and 6 would potentially conflict with three sites of archaeological or historical significance while Route 1 would conflict with two sites.

6.4.9 All of the alignments traverse portions of prime agricultural land. Routes 2 and 6 would have the most significant and long-term impact on farmland due to the permanent easement requirements of the open canal segment. The open canal alignments would also have the effect of visually and functionally dividing the farmland through which they would pass. This could hamper agricultural operations. Routes 1 and 3 could also have a relatively high impact on the farmland through which they would pass because of potential disturbance to irrigation and subsurface drainage systems in agricultural areas west of Cache Slough. Route 4 would have the lowest relative impact on farmland because it would make use of the existing Creed/Robinson Road right of way. Even considering the possible construction impacts of the aqueduct on adjacent agricultural operations, the most significant potential threat to prime agricultural land in Solano County would be created by the population growth that the additional aqueduct water supply would enable (see Section 6.2.2).

6.4.10 Numerous roadways and railroad lines would have to be crossed by all of the alternative alignments. Although all major crossings would be tunneled under, the potential for traffic disruption in urban areas would still be substantial. Route 1, with its extensive length through the urbanized areas of Fairfield, would have the highest potential for impacts to roadway crossings and traffic disruption in general. Route 7 would also have a high impact in these regards, largely because it would require crossing Highway 12 three times. The common alignment (Routes 2 through 7) through Suisun City would also have the potential for significant traffic disruption, particularly if the timing of aqueduct and Highway 12 bypass construction does not coincide.

6.4.11 Noise, dust, and other "typical" construction impacts would similarly be most noticeable for Route 1. The estimated duration of construction for the segment of Route 1 through Fairfield (9 months) and the presence of several highly sensitive receptors (hospital, rest home) increases the overall severity of impact for this alignment. The common alignment through Suisun City (Routes 2 through 7) would also cause considerable noise and dust annoyances, although the duration of construction through this urban area would be substantially less than that for Route 1.

6.4.12 Significant utility conflicts would also be evident along the alignment corridors (see Section 6.1.1.2). Route 1 would require the crossing of a considerable number of minor water and sewer lines through Fairfield, a few of which could cause some problems because of their depth of placement. Major utility crossings and relocations would characterize the common alignment for Routes 2 to 7 through Suisun City. In addition, Route 6, and possibly Route 5, would also require significant alteration to avoid two large above-ground electric transmission towers located within their proposed rights of way south of Creed Road. Numerous gas lines along Creed Road could also pose a problem during aqueduct construction.

6.4.13 A potential conflict with the City of Vacaville's existing waste water discharge would occur for all alignments that would intake on Calhoun Cut or Lindsey Slough. Vacaville is exploring the possibility of relocating its current discharge in Alamo Creek to Barker Slough, a tributary of Lindsey Slough, to eliminate the necessity of improving its waste water treatment system to an advanced level. Because the City of Vallejo already has a drinking water intake on Cache Slough it has been suggested that the most logical intake for the North Bay Aqueduct would be in this same area. /24/

6.4.14 The public safety hazard of the aqueduct would be minor for any of the pipeline alignments. The open canal alternatives (Routes 2 and 6) would have potential for loss of life through drowning. Above-ground structures (e.g., blow-off pipes) associated with pipeline portions of alternative alignments could also be a safety problem, particularly where these alignments pass through urban areas.

6.4.15 For a project with the magnitude of the North Bay Aqueduct, regulatory and jurisdictional involvement will be substantial regardless of which alignment is selected. However, some distinction in the degree of involvement can be made. For example, alignments which would cross any portion of the Suisun Marsh or a primary management zone of the Marsh would require a permit from the Bay Conservation and Development Commission (BCDC). The need for this permit would bring into the regulatory process a number of additional State and local agencies which typically review BCDC permit applications (see Section 2.2.2). The resulting delay in the processing of a formal application could result in significant cost escalations for the aqueduct. Route 1 as well as Routes 2 through 6 to the North Cordelia Forebay would entirely avoid the Marsh and, hence, the added regulatory involvement.

6.4.16 Another regulatory delay could occur with the selection of Routes 2 or 2A through the "core" of the Jepson Prairie. Negotiations to achieve compensation could delay aqueduct construction resulting in higher total costs. In addition, selection of Routes 2 or 2A presents the possibility of a lawsuit by a number of interested and concerned environmental organizations.

6.4.17 Estimated construction costs for the aqueduct would be highest for Route 3, primarily because of the extra pipeline length required for this alignment. Routes 1, 4, 5, and 7 would cost somewhat less to construct; Routes 2, 2A, and 6 would be even less expensive. Construction costs for secondary transport systems to deliver aqueduct water to the water-contracting agencies in Solano County would be substantially less for Route 1 than for the other alignments. This is primarily because Route 1 is closer to existing water transport and treatment facilities in Vacaville, Suisun City, and Fairfield. When total construction costs (aqueduct and secondary transport systems) are considered, Route 3 remains the most expensive alignment to build with Routes 1, 2, 2A, and 6 being the least expensive.

6.4.18 Annual operation and maintenance costs would be highest for Route 1, reflecting substantial energy requirements for pumping. Routes 3, 4, 5, and 7 would have somewhat lower annual operation and maintenance costs, although energy costs for these alignments to the North Cordelia Forebay would be somewhat higher. Routes 2 and 6 would have somewhat lower energy requirements because they could take advantage of gravity flow through the open canal segments. Route 1 has a distinct advantage over the other alignments under consideration with respect to the cost to pump water from the aqueduct to existing water treatment and distribution facilities in Vacaville, Fairfield, and Suisun City. Estimated operation and maintenance costs do not take into account the added expense of maintenance dredging and disposal, which

would be substantially higher with an intake on Calhoun Cut or Cache Slough as compared with Lindsey Slough.

6.5 PREFERRED AQUEDUCT ALIGNMENTS*

6.5.1 From the preceding environmental analysis, and a review of the information presented in Figures 6-1 through 6-11 and Table 6-3, two alignments have been selected as preferred for the construction of the North Bay Aqueduct. Routes 1 and 4 (to the North Cordelia Forebay) would best minimize adverse environmental effects in Solano County and provide the most efficient use of available resources. Through input received during public review of this Draft EIR/ES and more detailed analysis of several environmental factors suggested by this study, one preferred route will be discussed in the Final EIR/ES.

6.5.2 Routes 3 and 7 were not considered as environmentally desirable alternative alignments because of the longer required length of the aqueduct, impacts on the Jepson Prairie (even though they were designed, in part, to avoid the Prairie), and a significantly higher total cost to construct and operate. Routes 2 and 2A are not considered further in this report because of the significant implications on the Jepson Prairie (and associated rare and endangered species), conflicts with the designation of Calhoun Cut as a "natural area" in the proposed State Waterways Plan, the extensive amount of dredging required along Calhoun Cut, the need to construct additional access roads and, for Route 2 only, the encroachment of farmland and need to construct an additional pumping plant south of Travis AFB. Route 5 is not considered further because it would require unnecessary encumbrance of farmland (as compared with Route 4) and would have a higher potential for disruption of existing utilities along Creed Road.

6.5.3 Although the Route 6 alignment with an open canal would be somewhat less expensive to construct and share some of the other environmental advantages realized for Route 4, as well as offering additional recreational attributes, the potential for loss of human life through drowning must also be weighed. In addition, the development of Route 6 would permanently encroach on farmland along the alignment (particularly near the intake), conflict with utilities along Creed Road, and necessitate removal of the row of eucalyptus trees along Creed Road. Route 6, as an open canal, would also require the construction of a pumping plant south of the Travis AFB, consuming an additional acre of farmland in this area. Other disadvantages of an open canal along Route 6 would include a higher susceptibility to contamination of the water supply by hazardous materials and loss of a small percentage of the water supply from evaporation.

6.5.4 A major advantage of an aqueduct along Route 1 would be that the intake would be proximate to the City of Vallejo's existing intake and would enable the City of Vacaville to relocate its existing sewage discharge to Barker Slough without incurring the significant expense of advanced waste water treatment. The proximity of the Vallejo and North Bay Aqueduct intake would also create the possibility of coordinated maintenance dredging in Cache Slough. Another significant advantage of Route 1 would be that the costs of constructing and operating secondary water transport systems from the aqueduct would be substantially less. This would enable water-contracting agencies to minimize their costs so that ultimate water users

*The U. S. Army Corps of Engineers takes an impartial position as to whether to issue or deny a regulatory permit until public review is complete. Therefore, the "preferred" alignments referred to in this joint EIR/ES do not represent a Corps designation.

could benefit. Other significant beneficial attributes of a Route 1 alignment would include the avoidance of Suisun Marsh, lowest sensitivity with regard to cultural and archaeological resources, lowest probable impact on anadromous sport fish, use of an established right of way (Sacramento Northern), and a relatively moderate impact on major utilities. The timing of aqueduct construction with Phases II and III of the planned Fairfield linear park could minimize construction disturbances to surrounding residents. DWR would seek to extend the linear park bikeway at the same time the aqueduct is being constructed.

6.5.5 Significant disadvantages of Route 1 would include encumbrance of prime farmland with possible disruption of irrigation and subsurface drainage systems in the Cache Slough watershed, as well as displacement of fringe orchard areas in Suisun Valley, requirements for a substantial amount of initial and maintenance dredging, high operation and maintenance costs (particularly for energy consumption), and disruption of the social environment (traffic, noise, dust) through a long stretch of urban Fairfield. Disruption of Phase I and possibly Phases II and III of Fairfield's linear park system development would be a particular concern; however, this disruption might be counterbalanced by DWR's extension of the bikeway.

6.5.6 Another possibly significant disadvantage of Route 1 would be that Cache Slough water quality is apparently lower than that in Lindsey Slough (see Section 5.2.1.3 and Appendix C). In addition to the need for more detailed water quality data in Cache and Lindsey Sloughs to more specifically document differences, several aspects of the two watersheds merit further consideration. The Cache Slough watershed drains a larger area and is characterized by substantially more irrigation agricultural and urban runoff than the Lindsey Slough watershed. /25/ There is the possibility, therefore, that Cache Slough receives a higher loading of pesticides, fertilizers, and other contaminants than does Lindsey Slough, which drains an area characterized primarily by unirrigated agriculture and rural residential use. The Ulatis Creek Flood Control System, a main tributary source to Cache Slough, has been suspected of transporting an increasing load of sediment material into Cache Slough in recent years. However, steps are being taken to minimize this problem.

6.5.7 A major advantage of Route 4 is that it would use the established Creed/Robinson Road right of way, minimizing the need for encumbrance of surrounding farmland. The use of this right of way also reduces the potential conflict with utilities (including two large electric towers) along Creed Road, and the need to remove the row of eucalyptus trees along Creed Road which provide shade for livestock in the area. Other environmental advantages of Route 4, with the alternative leg to the North Cordelia Forebay, include the avoidance of Suisun Marsh, a lower disturbance to the Jepson Prairie, a reduction in any potential conflicts with endangered species and/or cultural resources, minimal initial and maintenance dredging requirements, and inclusion of an intake in a location of apparently better water quality. Another important advantage of Route 4 is that it would follow an alignment similar to that which was originally proposed back in the early 1960s and would therefore be more anticipated by local jurisidctions than Route 1.

6.5.8 Major disadvantages of Route 4 would be a significantly higher cost for secondary water transport systems to local contracting agencies, disruption of the urban area through Suisun City including possible relocation requirements for several major utility lines, displacement of some riparian habitat at the Lindsey Slough intake location, and a probable higher level of entrainment and/or impingement of anadromous sport fish in Lindsey Slough. The aqueduct along the Route 4 alignment would also potentially conflict with a relocation of

Vacaville waste water discharge to Barker Slough because of the Lindsey Slough intake and could require costly upgrading of Vacaville's existing Easterly treatment plant.

6.5.9 The final selection of alignment will be influenced by many factors, including those considerations that Napa and Solano Counties believe are significant. These would undoubtedly include impacts on the counties' plans for urban growth patterns. The Governor's Urban Strategy provides that "State departments will consult and cooperate with cities and counties when locating new State buildings and projects. Whenever possible, State projects should be built in existing urban areas, near public transit, and in those places where the projects will contribute most to each local community and have minimal environmental impact."

6.5.10 During the review period prior to the Final EIR, all county agencies affected by the North Bay Aqueduct should consider the impact of each route on future growth patterns prior to submitting a recommendation for a preferred route.

REFERENCES CITED:

/1/ Ford, Robert S. 1979. Geologic Appraisal of Vernal Pools, prepared for Department of Water Resources.

/2/ Delta Advisory Planning Council. August 1975. Delta Plan Technical Supplement, Chapter III, Delta Natural Resources.

/3/ California Resources Agency. September 1976. Sacramento-San Joaquin Delta Master Recreation Plan, Plate 1.

/4/ Letter from Chadwick, H. K. Department of Fish and Game to Department of Water Resources. October 29, 1979.

/5/ Madrone Associates. July 1980. Plan for Protection and Restoration of Sacramento-San Joaquin Delta Fish and Wildlife Habitat.

/6/ California Resources Agency. September 1976. Op. cit.

/7/ Calculations made using Swing, Jack W. May 1975. Draft Estimation of Community Noise Exposure in Terms of Day-Night Average Noise Level Contours. Office of Noise Control, California Department of Health.

/8/ Ibid.

/9/ Personal communication. Huffman, Jay. Fairfield Department of Public Works. March 1980.

/10/ Letter from Hornof, E. C. Division Land Supervisors. Pacific Gas and Electric Company to Madrone Associates. December 11, 1979.

/11/ Personal communication. Malloch, Barbara. Nature Conservancy. March 1981.

/12/ Personal communication. Folland, Erwin. City of Vallejo Water Department. July 1980.

/13/ Ibid.

/14/ Personal communication. Odenweller, Dan. California Department of Fish and Game. Bay-Delta Fishery Project. February 20, 1980.

/15/ California Department of Fish and Game, California Department of Water Resources, U. S. Fish and Wildlife Service, and U. S. Bureau of Reclamation. 1978. Interagency ecological study program for the Sacramento-San Joaquin estuary. Sixth Annual Report (1976).

/16/ Personal communication. Hyde, Herb. Department of Water Resources. July 1980.

/17/ Personal communication. Helm, Mike. U. S. Army Corps of Engineers, Sacramento District. April 1980.

/18/ Personal communication. Whisman, Ed. Department of Water Resources, Central District. September 1980.

/19/ Letter from Bledsoe, Brice, Secretary-Manager. Solano Irrigation District to Department of Water Resources. August 4, 1980.

/20/ U. S. Bureau of Reclamation. September 1979. Solano County Water Project Report (represents an approximate average of the mixed and high population growth assumptions).

/21/ Ibid.

/22/ State Department of Finance. 1979. E-150 Series Projections.

/23/ Personal communication. Munoz, Joseph, Vacaville Director of Public Works. April 1980.

/24/ Ibid.

/25/ Solano County. 1979. Northern Solano County Surface Runoff Management Plan.

7.0 UNAVOIDABLE ADVERSE ENVIRONMENTAL EFFECTS IF PROJECT IS IMPLEMENTED

	ALTERNATIVE AQUEDUCT ALIGNMENTS							
	1	2	2A	3	4	5	6	7
1. Farmland would be encumbered/ encroached.	M	H	M	M	L	M	H	M
2. Construction of the aqueduct would intersect numerous streams and drainage channels and could disturb subsurface irrigation and drainage systems.	M	L	L	M	M	M	M	M
3. Initial and maintenance dredging at the intake point would be required, temporarily increasing turbidity and disrupting riparian vegetation of the adjacent slough.	M	H	H	M	L	L	L	L
4. Disposal of dredge spoils would require additional purchase of land and/or transport to landfill.	M	H	H	M	L	L	L	L
5. Construction activities would disrupt native grassland by removing vegetation and altering the soil strata.	M	H	H	M	L	L	L	M
6. Construction activities would encroach in the primary management zone of Suisun Marsh.	-	M,*	M,*	M,*	M,*	M,*	M,*	M,H*
7. Areas of relatively high archaeological sensitivity could be revealed during construction of the aqueduct.	L	M	M	M	M	M	M	M

Note: Relative magnitude of environmental impact is indicated as appropriate
H = High, M = Moderate, L = Low, - = No Impact
* = Unique to alternative routing around Cordelia Hill to North Cordelia Forebay (Routes 2 - 7)

	ALTERNATIVE AQUEDUCT ALIGNMENTS							
	1	2	2A	3	4	5	6	7
8. Numerous roadways and railroads would be traversed during construction of the aqueduct.	H	M	M	M	M	M	M	H
9. Noise levels would increase during construction activities.	M	M	M	M	M	M	M	M
10. Numerous utility and service lines would be crossed.	M	M	M	M	M	M	M	M
11. Net energy use, including secondary facilities.	M	M	M	M	M	M	M	M
12. Prime agricultural land in Solano County would be displaced by urban development to accommodate population growth enabled by additional water supply.	M	M	M	M	M	M	M	M
13. Fish and other aquatic organisms would be entrained/impinged at the diversion intake.	L	M	M	L	M	M	M	M
14. Although the open canal segments of the North Bay Aqueduct would be fenced along their entire length, some public access to the canal would still occur, endangering the safety of these individuals.	-	H	-	-	-	-	H	-
15. Intake on Calhoun Cut would conflict with designation as "significant natural resource areas" in 1975 Delta Plan.	-	H	H	-	-	-	-	-
16. Water quality of additional supply would be lower than that for existing domestic supplies.	M	L	L	M	L	L	L	L

8.0 RELATIONSHIP BETWEEN SHORT TERM USES OF ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

	ALTERNATIVE AQUEDUCT ALIGNMENTS							
	1	2	2A	3	4	5	6	7
1. Prime agricultural soils would be disrupted and/or displaced, decreasing future production capability.	M	M	M	M	M	M	M	M
2. Construction across existing levees could affect their stability and consequently increase the local flooding hazard.	L	L	L	L	L	L	L	L
3. Construction could indirectly disrupt vernal pool hydrology, decreasing their ecological viability as a feature of the Jepson Prairie.	M	H	H	M	L	L	L	M
4. Construction activities would disrupt significant riparian habitat, decreasing biological productivity.	L	H	H	L	M	M	M	M
5. Construction of the aqueduct could impact threatened and endangered species, threatening their future existence in the area.	M	H	H	M	L	L	L	M
6. Construction in the Suisun Marsh could result in decreased biological productivity.	-	M,*	M,*	M,*	M,*	M,*	M,*	M,L*

Note: Relative magnitude of environmental impact is indicated as appropriate;
H = High, M = Moderate, L = Low, - = No Impact
* = Unique to alternative routing around Cordelia Hill to North Cordelia Forebay (Routes 2 - 7)

	ALTERNATIVE AQUEDUCT ALIGNMENTS							
	1	2	2A	3	4	5	6	7
7. Population growth (particularly around Suisun City and Fairfield) enabled by aqueduct entitlement would result in more congested roadways, lowered air quality, elevated noise levels, strains on some public services, diminished open space, wildlife resources, and other ecological effects.	H	H	H	H	H	H	H	H

9.0 IRREVERSIBLE OR IRRETRIEVABLE COMMITMENTS OF RESOURCES

	ALTERNATIVE AQUEDUCT ALIGNMENTS							
	1	2	2A	3	4	5	6	7
1. Energy would be required to manufacture the necessary steel and concrete, and diesel fuel would be used to operate construction machinery.	M	M	M	M	M	M	M	M
2. Permanent changes in land use would occur only where pump stations or other auxiliary facilities are required.	L	M	L	L	L	L	M	L
3. Permanent change in land use would occur along 60-foot wide right-of-way corridor.	-	H	-	-	-	-	H	-
4. Net energy use, including secondary facilities.	M	M	M	M	M	M	M	M
5. Delta water diverted through the aqueduct for consumptive M & I uses would not be available for other uses.	H	H	H	H	H	H	H	H

NOTE: Relative magnitude of environmental impact indicated as appropriate; H = High, M = Moderate, L = Low, - = No Impact.

10.0 PUBLIC PARTICIPATION

10.1 Public participation is a key element of the State and Federal environmental review processes. As discussed previously, a joint scoping session on the North Bay Aqueduct was held on December 11, 1979, in Fairfield to encourage public involvement in the early stages of project planning and design. Comments at this scoping session concerned the user costs of North Bay Aqueduct water associated with each of the various alignments, farmland traversed by the aqueduct right of way, and the extent to which "environmental factors" were going to influence the selection of an alignment.

10.2 Following completion of the draft EIR/ES, a 45-day public review period will commence, during which written comments on the draft report will be received. During or following this review period, a public hearing will be held to receive additional comments and questions. Written comments received during the initial review period, oral comments made at the public hearing, and any additional written comments will be addressed in a final EIR/ES.

10.3 To encourage an early and open process for identifying significant issues related to the North Bay Aqueduct project, three actions were taken by the U. S. Ary Corps of Engineers, San Francisco District. The first was to publish in the Federal Register a "Notice of Intent to Prepare a Draft Environmental Statement".

This was done November 20, 1979. The second action was to circulate a Notice of Preparation (NOP) announcing the project to interested and responsible Federal, State, and local agencies and asking for their comments and recommendations. The NOP was issued November 29, 1979. The third action was to participate in the joint State and Federal "scoping" session on December 11, 1979, in Fairfield.

10.4 Preparation and public review of an environmental impact statement is the primary mechanism for addressing and analyzing significant environmental issues. This report, a joint EIR/EIS, satisfies the requirements of NEPA regarding preparation of an ES and of CEQA regarding the preparation of an EIR. Copies of the EIR/ES were furnished to the following agencies:

FEDERAL AGENCIES

Advisory Council on Historic Preservation
Department of Agriculture
Department of the Army
Department of Commerce
National Oceanic and Atmospheric Admistration
Department of Energy
Department of Health, Education, and Welfare
Department of Housing and Urban Development
Department of the Interior
Fish and Wildlife Service
Heritage Conservation and Recreation Service, Pacific Southwest Region
Department of Transportation
Environmental Protection Agency
Federal Energy Regulatory Commission
Federal Maritime Commission
Water and Power Resources Service

STATE AGENCIES

The Business and Transportation Agency of California
The Health and Welfare Agency of California
Office of Planning and Research
The Resources Agency of California
- Department of Fish and Game
- Department of Boating and Waterways
- Department of Parks and Recreation
- Air Resources Board
- Central Valley Regional Water Quality Control Board
- San Francisco Bay Conservation and Development Commission
- State Lands Commission
- State Reclamation Board
- State Water Resources Control Board

REGIONAL AGENCIES

Association of Bay Area Governments
Bay Area Air Pollution Control District

COUNTY AGENCIES

Napa Planning Department
Napa Public Works Department
Solano Planning Department Department
Solano County Public Works
Solano Irrigation District
Solano County Mosquito Abatement District
Suisun Resource Conservation District

CITY AGENCIES

Benicia Planning Department
Benicia Public Works Department
Dixon Planning Department
Dixon Public Works Department
Fairfield Planning Department
Fairfield Public Works Department
Fairfield-Suisun Sewer District
Fairfield-Suisun Unified School District
Napa Planning Department
Napa Public Works Department
Rio Vista Planning Department
Rio Vista Public Works Department
Suisun City Planning Department
Suisun City Public Works Department
Vacaville Planning Department
Vacaville Public Works Department
Vallejo Planning Department
Vallejo Public Works Department

ENVIRONMENTAL GROUPS

Benicians for Environmental Action
California Native Plant Society - Berkeley
California Natural Areas Coordinating Council - Sonoma
California Tomorrow - San Francisco
California Trout - San Francisco
California Waterfowl Association - Menlo Park
California Wildlife Federation - Davis
Davis Audubon Society
Delta Environmental Advisory Committee
Ecology Center - San Francisco
Environmental Defense Fund - Berkeley
Friends of the Earth - San Francisco
Golden Gate Audubon Society - San Francisco
League of Women Voters - San Francisco
Napa-Solano Audubon Society - Fairfield
National Resource Defense Council - Palo Alto
Nature Conservancy - San Francisco
Open Space Committee - Fairfield
People for Open Space - San Francisco
Planning and Conservation League - Sacramento
San Francisco Bay Chapter Oceanic Society
Save San Francisco Bay Association
Sierra Club - San Francisco
Sierra Club - Vallejo

11.0 GLOSSARY

A

AF - acre-foot: a volume of water 1 foot deep and 1 acre in area or 43,560 cubic feet (325,851 gallons). AF/YR: Acre-feet per year.

Alluvium: a deposit of sand, silt, and gravel formed by flowing water.

Anadromous fish: fish which inhabit ocean waters and move into fresh water to spawn.

Aquifer: a porous, water-bearing geologic formation capable of yielding an appreciable supply of water.

B

Bay mud: a soil type composed mainly of highly compressible silts and clays characteristic of marshy areas.

Billowing: a gentle rising and falling such as low rolling hills.

Brackish water: slightly saline; containing from 0.5 to 30 parts per thousand salinity.

BTU - British thermal unit: the amount of heat required to raise the temperature of 1 pound of water 1 degree Fahrenheit.

C

cfs - cubic feet per second: a unit of measure of the rate of liquid flow past a given point equal to one cubic-foot in one second.

Channelization: the alteration of a watercourse, generally making it straighter or deeper, to improve navigation or for flood control.

Coalescent: to unite or merge into a single body, group, or mass.

Conjunctive use: the joint or coordinated use of, in this case, surface and ground water supplies.

Consolidated: to be made stronger, solid, and firm by compaction.

Corps - U.S. Army Corps of Engineers, San Francisco District.

Culvert: a pipe or channel which crosses under a road, building, or other structural obstacle.

Cumulative impact: refers to two or more individual effects which, when considered together, compound or increase the total environmental impact.

D

Decibel: a unit for measuring the relative "loudness" of sounds.

Desalination: to remove the salt from seawater.

Dewater: to remove water (*e.g.*, by pumping).

Diversion: the changing from one course to another (*e.g.*, a waterway diversion).

Diversity: having variety, various forms or qualities.

Dredge spoils: materials (soil, mud, rock) resulting from digging within a stream or other water course).

DWR - Department of Water Resources.

E

Ebb: the flowing back of the tide toward the sea; low tide.

Effluent: wastewater or other liquid, partially or completely treated, flowing from a point source.

Emission: something released into the environment (*e.g.*, air pollutant).

Encroachment: displacement beyond desirable or normal limits.

Encumbrance: something that impedes or hampers the function or activity of.

Entitlement: the legal right to, in this case a water allocation.

Entrainment: to be drawn or carried along or through such as fish being pulled into the aqueduct.

F

Flood-plain: the low, flat ground surrounding a stream channel subject to periodic flooding.

Forage fish: small fish providing a food source for larger fish and other animals.

Forebay: a water reservoir, used for temporary storage prior to further distribution.

Fry: newly hatched fish.

G

Genera: categories of biological classification ranking between the broader family and more specific species, marked by common characteristics.

Gill nets: a net of a specified mesh size which, when stretched across a stream, traps fish by the gills.

Grab sample: a device for collecting materials and organisms from the bottom of a watercourse.

Growth inducement: ways in which population growth could be fostered.

H

Habitat: the place or type of site where a plant or animal naturally or normally lives and grows; the place where it is commonly found.

Heterogeneous: consisting of dissimilar ingredients or constituents.

Hummock: a rounded knoll or hillock.

I

Impingement: the collision or trapping of fish or other organisms against intake screens.

Interim: temporary.

Intermittent streams: flowing in winter and dry during summer.

Introduced vegetation: plants that are not native to an area but are now occurring there.

Inorganic chemicals: chemicals composed of matter other than plant or animal material; minerals.

Inversion: an increase in air temperature with an increase of altitude, instead of the normal decrease.

J

Juvenile: young fish that resemble the adult of the species in appearance but are not sexually mature.

L

Larvae: young fish which are imperfectly developed and differ strongly in appearance from the adult.

Leach: the flushing of salts from the soil by percolating water through it.

Liquefaction: the process of making or becoming liquid; earthquake-induced shaking could transform sandy soils into a liquid state.

M

Marsh enhancement: the use of wastewater to either create new marshlands or to maintain and/or improve existing marshlands.

mg/l - milligrams per liter: a measure of the concentration of a substance in a liter of liquid.

M & I - municipal and industrial.

Migratory: characterized by moving, usually periodically, from one region or climate to another for feeding or breeding.

Mitigation: measures designed to reduce the intensity or extent of an impact.

O

Organic chemicals: chemicals derived from living organisms, containing carbon compounds.

Otter trawl: a device towed from the back of a boat used to collect bottom-dwelling fish.

Outcrop: a usually underground geological feature that is exposed on the surface.

Oxidant: an airborne substance which is formed by a reaction between nitrogen oxides and hydrocarbons in the presence of sunlight.

P

Particulate: an airborne particle (*e.g.*, dust).

Per capita: by or for each unit of population.

Percolation: to filter or pass through, as water through a sand layer.

Perennial: a plant that grows during all seasons of the year.

Permeability: the property or condition of the soil that relates to the passage of water or air through it.

Plastic: the capacity of a soil to be changed in shape under applied stress and to retain the impressed shape after removal of the stress.

ppb - parts per billion: a measure of concentration.

ppm - parts per million: a measure of concentration.

Primary impact: direct environmental consequences of a proposed action.

Purveyor: a supplier, usually as a matter of business.

R

Receptor: a receiver (*e.g.* building, person) of some effect or event.

Recharge: replenish, refill.

Retrofit: to go back and install devices on or make adjustments to existing structures.

Riparian: an animal or plant species located along and to some degree dependent on a watercourse for survival.

S

Safe yield: the amount of water that could be derived from a particular source (reservoir, groundwater, *etc.*) without endangering future suppliers or causing other adverse impacts.

Saltwater intrusion: the introduction of seawater into a freshwater body (surface or underground).

Saturated zone: an area in which the moisture content is so high that no more water can be absorbed and retained.

Secondary impact: indirect environmental effects of a proposed action including the social, economic, and environmental effects that would result from the additional population growth enabled that proposed action.

Secondary water transport system: the water conveyance system that would transport water from a main water system (e.g., North Bay Aqueduct) to individual contracting agencies (e.g., City of Fairfield).

Sedimentation: the process of depositing materials from a liquid, especially in bodies of water when the velocity is reduced.

Seine: a large net with sinkers on one edge and floats on the other used vertically to enclose fish when its ends are brought together or drawn ashore.

Seismicity: subject to or caused by an earthquake or ground shaking.

Shrink-swell potential: the relative change in volume of soil material to be expected with changes in moisture content.

Subsidence: to sink or fall or to flatten out so as to form a depression.

Surge tank (tower): a structure used to hold water on a temporary basis in order to equalize the rate of flow through a transport system.

SWP - State Water Project.

T

TDS - total dissolved solids: a quantitative measure of the residual of minerals dissolved in water that remain after evaporation of a solution. Usually expressed as ppm or mg/l.

U

Unincorporated area: areas that are not included within official boundaries of a city and remain under county jurisdiction.

Urbanized area: a central city or a group of contiguous cities with a 1970 population of 50,000 or more, together with adjacent densely populated areas having a population density of at least 1,000 persons per square mile.

V

Vernal pools: are small depressions in the ground which fill with water during the winter and gradually dry up in the spring and summer.

W

Wastewater: spent or used water from every source, municipal, industrial, and agricultural.

Wastewater reclamation: use of treated wastewater (e.g. industrial cooling water, agricultural irrigation) instead of directly disposing of it.

12.0 LIST OF PREPARERS

Name	Discipline	Experience	Role in Preparing ES
DEPARTMENT OF WATER RESOURCES			
Edward E. Whisman	Environmental Documentation	5 years	Project Manager
Robert D. Grow	Resources Planning	4 years	Contributor/Editor
Richard Soehren	Environmental Planning	2 years	Contributor
CORPS OF ENGINEERS, SAN FRANCISCO DISTRICT			
Rod Chisholm	Environmental Planning	10 years, Environmental Branch, San Francisco District, COE	Federal Review
Barney Opton	Environmental Planning	6 years, Environmental Branch, San Francisco District, COE	Federal Coordination and Review
Scott Miner	Environmental Planning	2 years, Environmental Branch, San Francisco District, COE	Federal Review
MADRONE ASSOCIATES			
Nona B. Dennis	Environmental Planning	8 years	Principal-in-Charge
Gary Oates	Environmental Planning	4 years	Project Director
Terri A. Nevins	Environmental Planning	2 years	Assistant Project Director
Diane L. Renshaw	Wildlife Ecology	7 years	Consulting Specialist
J. Michael Lyons	Aquatic Biology	4 years	Research Assistant
Yuki Kawaguchi	Geography/ Cartography	9 years	Cartography and Graphics Production

Name	Discipline	Experience	Role in Preparing ES
ENVIRONMENTAL SCIENCE ASSOCIATES*			
Charles Bennett	Water Resources Engineering	12 years	Principal-in-Charge, Technical Review
Michael Rice	Urban Planning	9 years	Project Manager
Michael O'Connor	Transportation and Energy Planning	5 years	Research Assistant
Georgia Marino	Geology	3 years	Research Assistant
CAMP, DRESSER AND McKEE, INC./WATER RESOURCES ENGINEERS, INC.*			
Larry Davis	Environmental Engineering	13 years	Principal-in-Charge
Wayne Harvey	Water Resources Analysis	6 years	Project Manager, Hydraulic Modeling
Henry Boucher	Environmental Planning	3 years	Associate
DAVID CHAVEZ AND ASSOCIATES*			
David Chavez	Archaeology/ Anthropology	10 years	Consulting Archaeologist
GRIGGS AND WHITLOW			
F. Thomas Griggs	Botany/Plant Ecology	12 years	Consultant
Thomas H. Whitlow	Plant Ecology	8 years	Consultant

*Firm associated with Madrone Associates

NORTH BAY AQUEDUCT (PHASE II FACILITIES)

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APPENDICES

APPENDIX A

ASSUMPTIONS AND INFORMATION SOURCES

WATER CONSERVATION PROGRAM - NAPA AND SOLANO COUNTIES

Demographics

1. 1980 population figures are E-150 projections (as revised January 1980) California Department of Finance.
2. 2000 population figures are E-150 projections, California Department of Finance.
3. Household projections for 1980 and 2000 are from Provisional Household Projections of California Counties to 2000, California Department of Finance Report 77 P-2, December 1977.

Energy Cost and Consumption

1. An oil price of $35.00 per barrel has been used.
2. Energy consumption calculated at the rate of 32.2 barrels of oil to raise the temperature of one acre-foot of water from 60 degrees F to 102 degrees F (DWR Bulletin 191, Appendix A).

Urban Water Demand

1. 1980 demand is taken from Water Action Plan for the Southwest Sacramento Valley Service Area, Progress Report, California Department of Water Resources, July 1978.
2. 2000 urban demand is taken from Water Action Plan for the Southwest Sacramento Valley Service Area, California Department of Water Resources, July 1980 reduced by OWC calculation of mandatory conservation savings for toilet, shower, and faucet.

County	1980 Demand	2000 Raw	2000 Adjusted
Solano	59,200 af	87,800 af	84,500 af
Napa	23,200 af	34,000 af	33,000 af

Capital Recovery Factors

1. Calculation of yearly costs was based on the following capital recovery formula:

$$\frac{i(1 + i)^n}{(1 + i)^n - 1} = CRF$$

   Where i = interest rate, n = payback period in years.

   Formula from Principles of Engineering Economy by Grant, Copyright 1950.

2. Interest rate used was 7.125%.

Device Distribution

1. Calculations based upon 1.5 showers, 1.5 toilets per household.
2. Attition rate of existing housing, 1980-2000, assumed to be 6% (from Southern California Association of Governments).
3. Cost of kit is \$.85 (\$.60 + \$.25 for additional bag and extra shower flow restrictor).
4. Kit installation rate = 40% for bags, 10% for shower restrictors.
5. Daily reduction in shower hot water use, kit or installation, is 12 gallons per person.
6. Bag installation saves .69 gallons/flush.
7. Dam installation saves 1.65 gallons/flush.
8. Faucet restrictors cost \$1.71 each, and average 2.5 per household.
9. A free installation program would retrofit 75% of the showers. Of these retrofitted, 80% would be with restrictors and 20% would be showerheads. Restrictors cost \$.05, new heads \$2.00.
10. Toilet use rate is assumed to be 5 flushes/person/day.

Municipal vs. Industrial Water Requirements

1. Current estimate and future projection for Solano County taken from Solano County Water Project California - A Report on the Feasibility of Water Supply Development, Preliminary Draft, U.S.D.I. Bureau of Reclamation, September 1979.

	1979	2000 (Mixed Alternative)
% Municipal	67%	53%
% Industrial	33%	47%

2. Urban water use in Napa County assumed to be 82% municipal, 18% industrial, current and 2000.

Leak Detection and Repair

1. Leakage rate of 4% taken from DWR Bulletin 198.
2. Information on costs, average size of leaks, time to complete leak detection survey taken from EBMUD, as reported in "Public Works", June 1976, and the "Journal of the American Water Works Association", February 1979.

Pressure Regulation

1. Benefits of pressure regulation (5% savings) from DWR 198.
2. Costs obtained from Watts Regulator Company, Lawrence, Massachusetts.
3. Water pressure data collected by Julie Power, July 1[illegible], 19[illegible]:

City	System Pressure, psi
Vacaville	30-105
Fairfield	54-65
Napa	30-130
Vallejo	40-135

4. Interior residential use assumed to be 56% of total residential, 40% of interior residential is pressure-affected, and 90% of pressure-affected water is heated (Bulletin 198).

APPENDIX B

AQUEDUCT FACILITIES SCHEMATICS

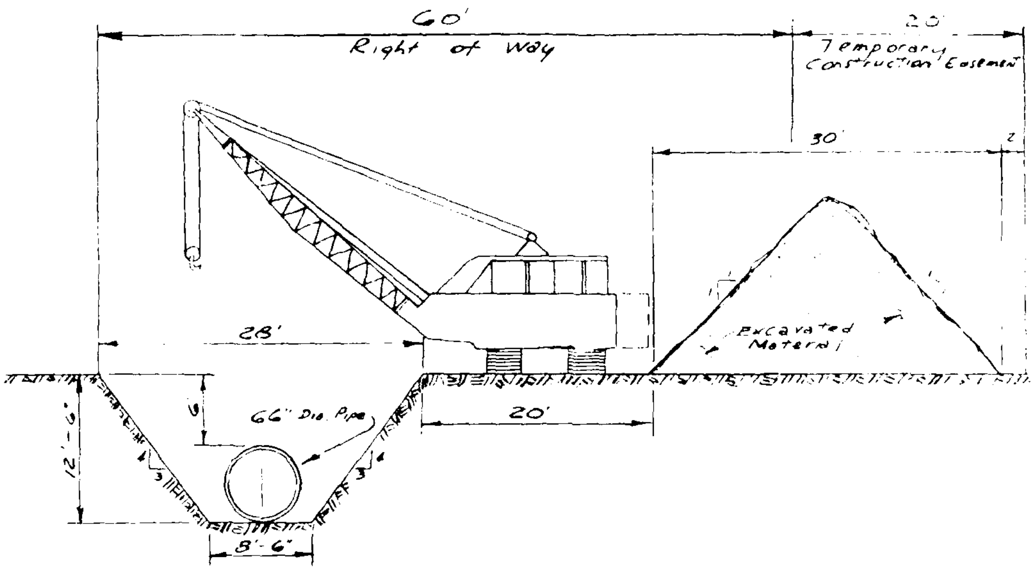

FIGURE 1

CROSS SECTION OF PIPELINE DURING CONSTRUCTION

Sources: Dept. of Water Resources, 5-7-75.

AD-A116 061 CORPS OF ENGINEERS SAN FRANCISCO CA SAN FRANCISCO DI--ETC F/G 13/2
NORTH BAY AQUEDUCT (PHASE II FACILITIES), SOLANO COUNTY, CALIFO--ETC(U)
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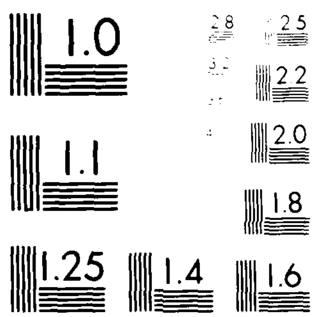


MICROCOPY RESOLUTION TEST CHART

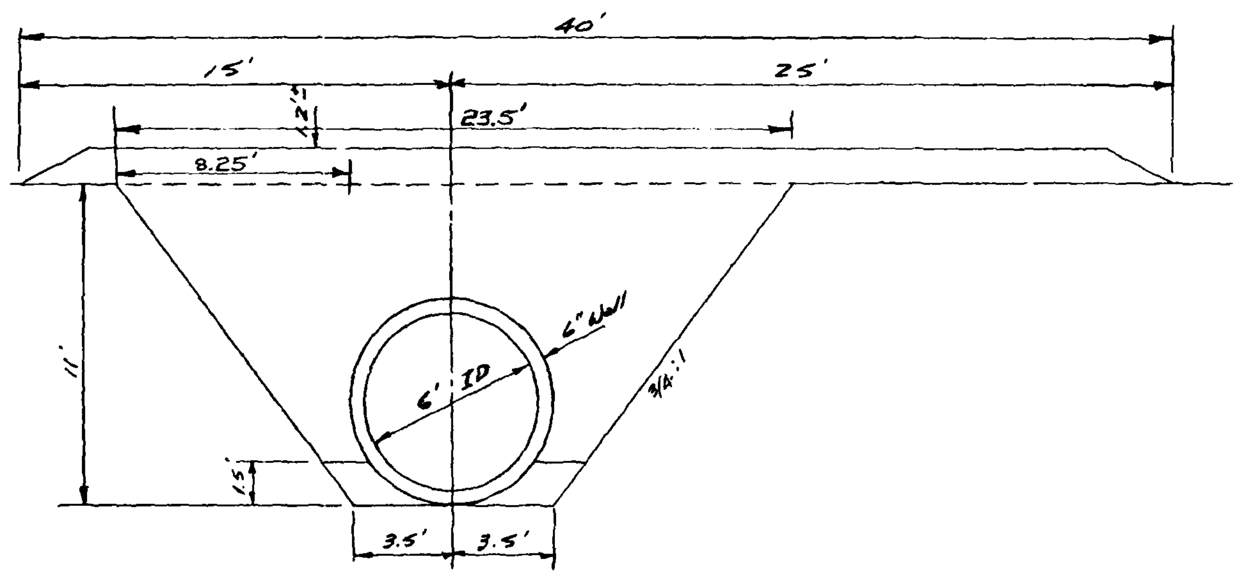


FIGURE 2

CROSS SECTION OF PIPELINE AFTER CONSTRUCTION

Source: Dept. of Water Resources, 11-21-79.

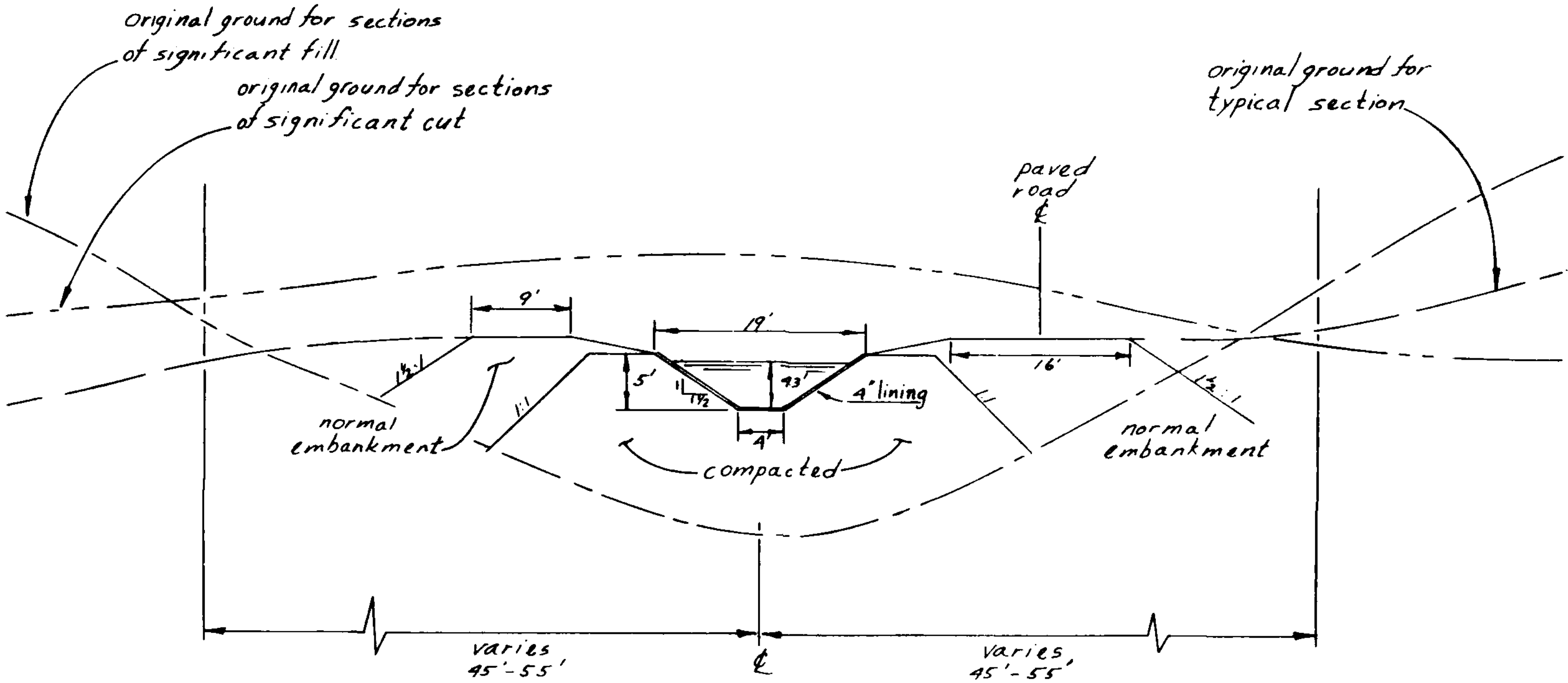


FIGURE 3

NORTH BAY AQUEDUCT PHASE II - CANAL TYPICAL CROSS SECTION

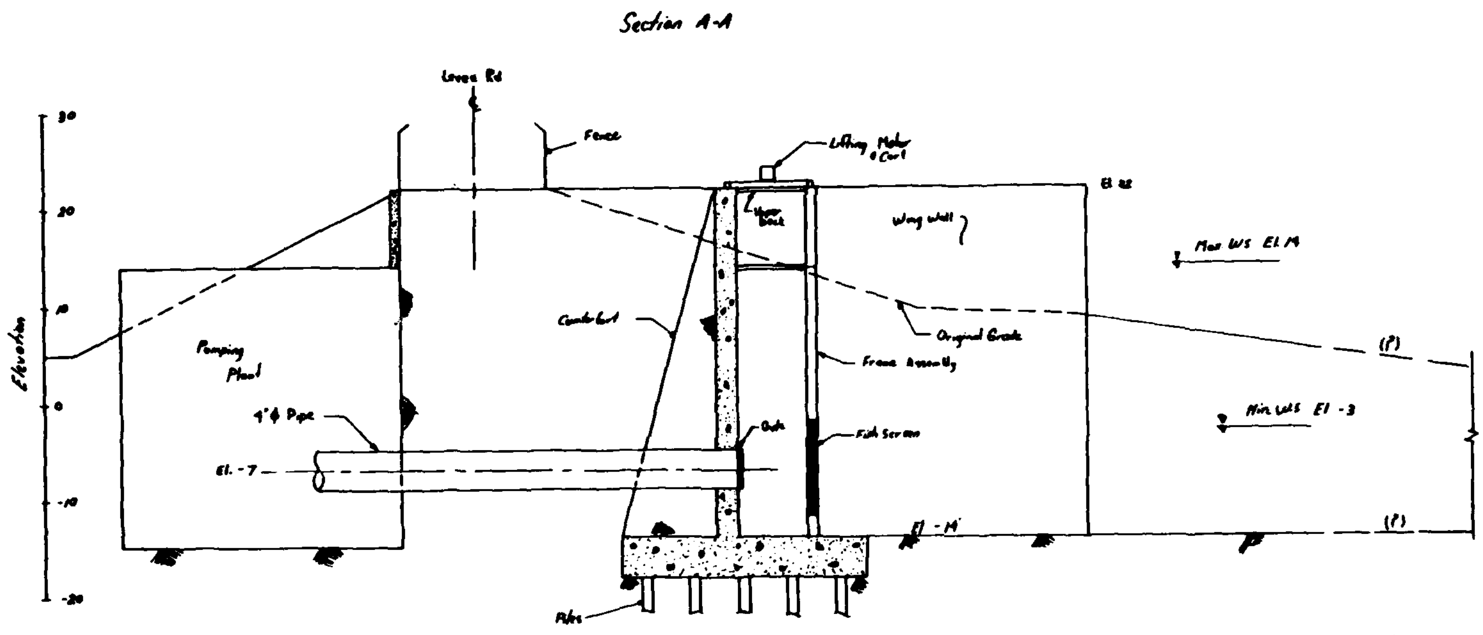


FIGURE 4

NORTH BAY AQUEDUCT PHASE II - CACHE SLOUGH PUMPING PLANT

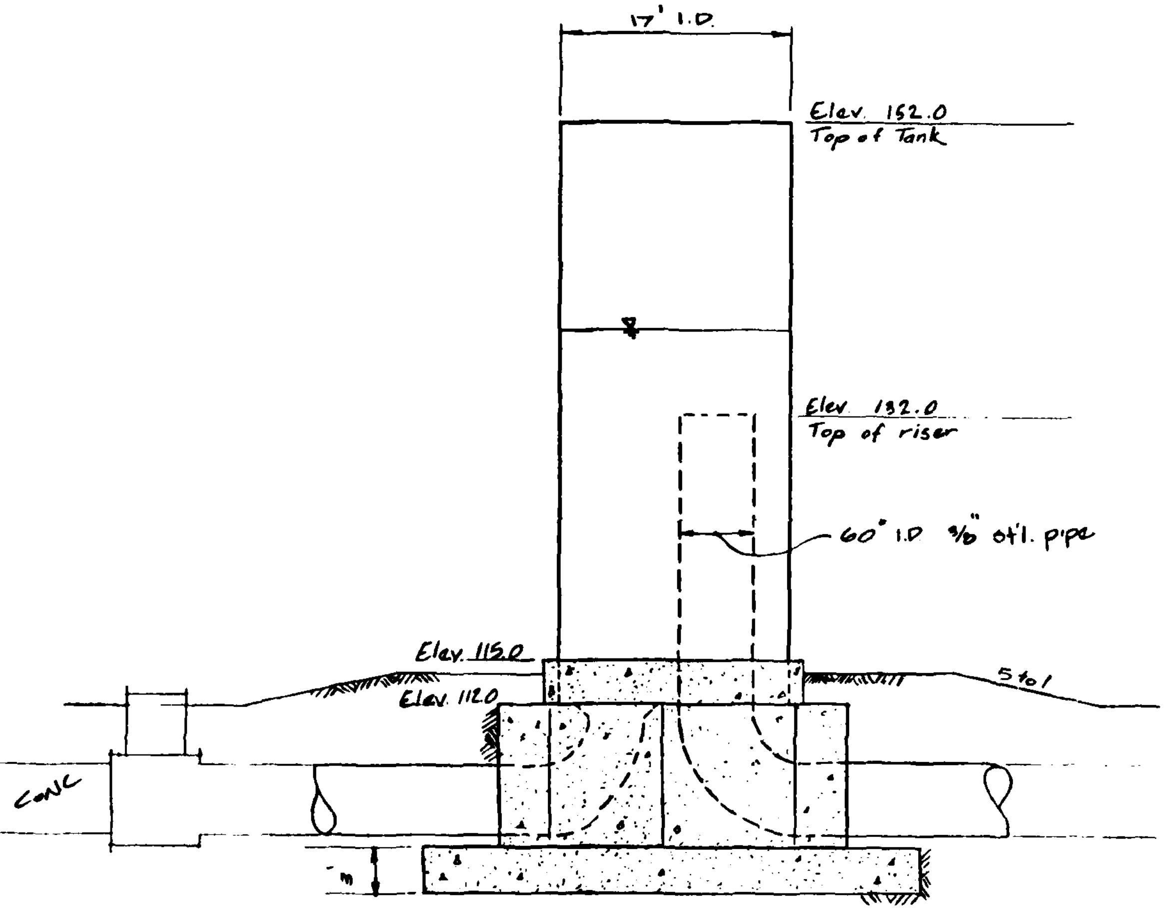


FIGURE 5

NORTH BAY AQUEDUCT TRAVIS SURGE TOWER

APPENDIX C

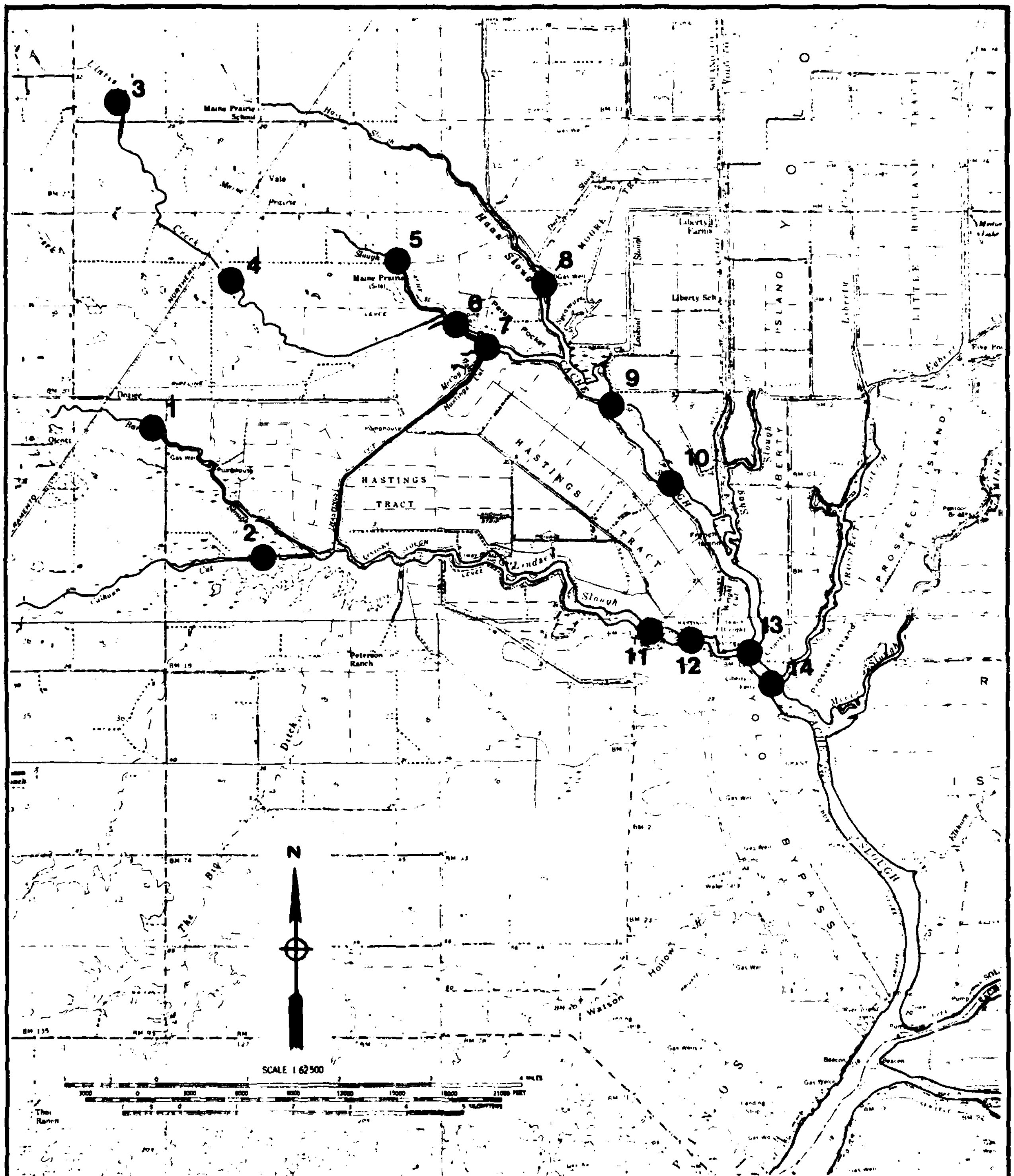
HYDRAULIC AND WATER QUALITY SETTING IN CACHE AND LINDSEY SLOUGHS

Historical water quality and hydraulic data in the vicinity of the proposed diversion points on Cache Slough, Lindsey Slough and Calhoun Cut are very limited. However, enough information is available to develop a general overview of the basic water quality and hydraulic characteristics of the region.

Cache and Lindsey Sloughs are located north of Rio Vista and west of Walnut Grove (Figure 1). Cache Slough lies to the east and north of Hastings Tract while Lindsey Slough lies to the south. These two sloughs are connected at their upstream ends by Hastings Cut. Lindsey Slough is extended by Calhoun Cut and Barker Slough, but is generally considered to be a deadend waterway. Cache Slough is extended by Haas Slough and Ulatis Creek which drains a major portion of the Solano County watershed area. The City of Vallejo diverts water for M&I use from Cache Slough and there are agricultural withdrawals and returns from both Cache and Lindsey Sloughs.

Water Quality Characteristics

Considerable water quality data is available for Cache Slough at the City of Vallejo intake. This data dates back to the original placement of the diversion in 1953. Weekly chloride data are available in the Vallejo Water Treatment Plant laboratory records from 1953 to the present. Total dissolved solid (TDS) measurements began in 1975. Monthly (single) grab sample data for chlorides and TDS are available for Lindsey Slough (above the Liberty Island Ferry) from 1952-65 (DWR Bulletin No. 65). Additional samples were collected on an irregular basis until 1969. Occasional grab sample data are also available for Barker Slough, Calhoun Cut, Ulatis Creek, Haas Slough and other locations on Cache and Lindsay Sloughs. A summary of the TDS and Chloride data available is presented in Table 1 and the various sample locations are identified in Figure 1.



Historical Grab Sample Stations

Figure 1 - GEOGRAPHICAL LOCATION
OF CACHE AND LINDSEY SLOUGHS

TABLE 1

HISTORICAL SAMPLE LOCATION, DATES AND
AVAILABLE WATER QUALITY DATA

	Location	Period	EC	TDS	CL
1	Barker Slough	12/28/51	x	x	x
		2/23/53	x	x	x
2	Calhoun Cut	6/10/68	x		x
		11/15/68	x		x
3	Ulatis Creek	6/2/52	x	x	x
		3/23/53	x	x	x
4	Ulatis Creek	4/17/72	x	x	
		7/13/72	x	x	
		9/6/72	x	x	
		5/14/73	x	x	
		7/24/73	x	x	
		8/27/73	x	x	
		9/24/73	x	x	
		6/24/74	x	x	
		8/22/74	x	x	
		10/24/74	x	x	
		6/10/75	x	x	
5	Cache Slough	6/11/54	x	x	x
		7/26/54	x		x
		8/18/54	x	x	x
		6/10/68	x		x
6	Cache Slough	1953-1979			x
		1975-1979 (Weekly)	x	x	
7	Cache Slough	6/14/54	x	x	x
		7/23/54	x		x
		8/18/54	x	x	x
8	Haas Slough	6/10/68	x		x
9	Cache Slough	4/28/53	x	x	x
		5/14/53	x	x	x
		6/16/53	x	x	x
		6/10/68	x		x
10	Cache Slough	6/10/68	x		x

TABLE 1
(Continued)

	Location	Period	EC	TDS	CL
11	Lindsey Slough	10/28/52 9/10/69	x	x	x
12	Lindsey Slough @ Hastings Tract Ferry	6/14/54	x	x	x
		10/20/54	x	x	x
		12/2/54	x	x	x
		1/21/55	x	x	x
		3/10/55	x	x	x
		5/5/55	x	x	x
		6/22/55	x	x	x
		8/3/55	x	x	x
		9/13/55	x	x	x
		11/1/55	x	x	x
13	Cache Slough	8/31/60	x		x
		6/10/63	x		x
14	Cache Slough	6/11/54	x	x	x
		7/26/54	x	x	x

Analysis of the data for Cache Slough (at Vallejo intake) and Lindsey Slough (above Liberty Island Ferry) provides an indication of the general water quality characteristics in the region. Tables 2 and 3 provide and mean monthly TDS and Chloride values for Lindsey Slough and Cache Slough, respectively, over the selected periods of record. Figure 2 presents the yearly average TDS and Chloride data for each location and Figure 3 presents the monthly average data for each period of record at each location. As suggested in Figure 2, the chloride concentrations in Cache Slough show a generally linear increase over the 1960-65 and 1970-76 periods. Since the quality of Sacramento River water (at Rio Vista) has remained relatively constant over the period, these increases in Chloride concentration may reflect changes in agricultural practices in the region over many years. In the 1977-79 period, however, the chloride values increase significantly. A similar increase is observed in the TDS values for Cache Slough between 1977 and 1979. A plot of the monthly TDS values for each of the years between 1975-79 (Figure 4) indicate a much higher concentration during the spring months. These higher concentrations probably reflect the build-up of mineral salts in the soils during the 1976-77 drought period and the subsequent drainage after the return to normal hydrologic conditions in 1978-79. As indicated in Figure 3, the TDS and Chloride concentrations are, generally, higher during the spring runoff period and decrease during the summer months when better quality Sacramento River water is being drawn into the upper reaches of the Slough.

A complete analysis of the water at the City of Vallejo intake was conducted in September 1973. The results of the analyses are presented in Table 4.

The water quality data for Lindsey Slough (1953-65) appears to be of slightly better quality than found for Cache Slough. The plot of the yearly average chloride values (Figure 2) indicates a less rapid rate of increase in concentration over the same 1960-65 period than observed in Cache Slough. The TDS values, although variable from year to year, also show a relatively

TABLE 2

LINDSEY SLOUGH TDS AND CHLORIDE DATA FOR THE PERIOD 1953-65

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Yearly Mean±S.D.
TDS mg/l													
1953	206	209	163	126	125	110	98	159	189	151	131	117	149±37
1954	144	144	168	166	116	157	153	161	205	175	144	197	161±24
1955	192	194	121	127	120	114	141	141	200	144	132	128	151±32
1956	196	214	203	165	152	102	114	117	135	116	115	111	146±40
1957	130	129	152	112	118	124	122	125	134	134	109	110	125±12
1958	183	153	133	116	141	148	125	132	138	108	104	103	132±23
1959	146	135	171	124	126	149	141	115	136	136	127	125	136±15
1960	132	132	153	112	116	135	118	119	134	136	124	126	128±11
1961	125	176	165	127	126	143	136	120	140	144	137	182	143±21
1962	143	148	179	170	126	144	126	126	130	130	154	152	144±18
1963	215	112	268	228	212	209	170	139	145	137	126	164	177±48
1964	143	205	160	156	133	149	141	133	135	136	127	140	147±21
1965	147	185	233	159	176	143	136	130	135	134	106	114	150±35
Monthly Mean S.D.	162±32	164±34	179±36	145±33	137±28	141±26	132±18	132±15	150±28	137±16	126±15	136±29	
SD/x̄	.20	.21	.20	.23	.20	.18	.14	.11	.19	.12	.12	.21	
Chlorides mg/l													
1953	20	22	18	11	10	10	8	16	24	17	12	9.8	14.8±5.4
1954	14	13	17	16	9.2	18	16	18	29	22	15	26	17.8±5.5
1955	27	25	24	12	12	11	13	14	26	14	12	12	16.8±6.5
1956	15	18	16	15	13	8	8.4	8.2	12	8.8	8	6	11.8±3.6
1957	9	11	16	7.5	10	10	9.1	11	12	13	8	8.5	10.4±2.4
1958	21	20	12	16	13	14	12	13	12	8.7	8	7.5	13.1±4.3
1959	17	12	20	11	12	16	14	10	12	14	13	9.8	13.4±3.0
1960	10	14	18	10	10	13	9.5	9.4	11	11	8.5	14	11.5±2.7
1961	10	22	17	10	9.4	12	14	9.4	11	14	12	24	13.7±4.9
1962	14	16	19	14	14	15	11	11	12	11	17	15	14.1±2.5
1963	28	8.8	37	24	22	24	19	13	13	13	9.5	19	19.2±8.3
1964	13	27	18	16	15	14	11	8.5	12	12	8.3	12	13.9±5.0
1965	14	14	28	17	16	16	13	11	11	9.5	5.1	8	13.6±5.8
Monthly Mean S.D.	16±6	17±6	20±6	14±4	13±4	14±4	12±3	12±3	15±6	13±4	10±3	13±6	
SD/x̄	.37	.33	.32	.31	.28	.30	.26	.25	.43	.28	.32	.48	

TABLE 3

CACHE SLOUGH TDS DATA FOR THE PERIOD 1975-79 AND CHLORIDE DATA FOR THE 1960-65 AND 1975-79 PERIODS

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	
TDS mg/l													
1979	249	297	380	345	234	189	199	199	189	231	287	237	253±62
1978	225	289	301	390	255	185	201	207	202	202	278	232	247±59
1977	234	243	239	164	182	174	159	159	201	196	240	269	205±38
1976	188	189	189	183	169	152	166	178	189	221	216	254	191±28
1975	238	210	210	217	197	188	173	166	184	238	247	230	207±27
Mean ± S.D.	227±23	245±47	261±81	260±101	207±36	178±16	180±19	182±21	193±8	218±18	254±29	244±17	
$S/\bar{x}$	.10	.19	.31	.39	.19	.09	.11	.11	.04	.08	.11	.07	
Chloride mg/l													
1979	66	74	107	100	57	46	56		53	64	84	89	72±20
1978	53	71	64	97	80	62	54	52	39	50	85	83	66±17
1977	86	76	75	46	51	57	57	52	61	77	77	97	68±16
1976	56	36	44	33	29	27	32	28	39	43	57	76	42±15
1975	65	46	41	43	39	31	29	28	28	53	67	64	45±15
1974	29	59	N.A.	N.A.	N.A.	33	29	28	30	36	55	58	40±14
1973	44	32	50	57	36	33	29	28	31	42	47	49	40±10
1972	38	51	45	25	25	23	24	22	25	40	47	56	35±12
1971	38	65	61	37	30	32	22	31	21	34	42	N.A.	37±14
1970	36	43	55	42	27	31	24	24	24	34	45	33	35±10
Mean ± S.D.	51±18	55±16	60±21	53±27	42±18	38±13	36±14	33±11	35±13	47±14	61±17	66±20	
$S/\bar{x}$	.34	.29	.34	.51	.44	.35	.39	.35	.37	.30	.28	.31	
Chloride mg/l													
1960	15	22	21	22	15	16	15	15	17	18	17	20	18±3
1961	20	21	26	25	19	20	21	19	17	17	18	19	20±3
1962	24	21	25	28	20	21	18	19	18	19	25	26	22±3
1963	26	29	35	19	32	30	23	21	21	10	17	24	24±7
1964	27	37	34	25	18	20	22	21	21	21	25	33	25±6
1965	21	39	49	38	36	25	23	22	21	24	26	28	29±9
Mean ± S.D.	22±4	28±8	32±10	26±7	23±9	22±5	20±3	20±3	19±2	18±5	21±4	25±5	
$S/\bar{x}$	.18	.29	.31	.27	.39	.23	.16	.13	.11	.26	.21	.21	

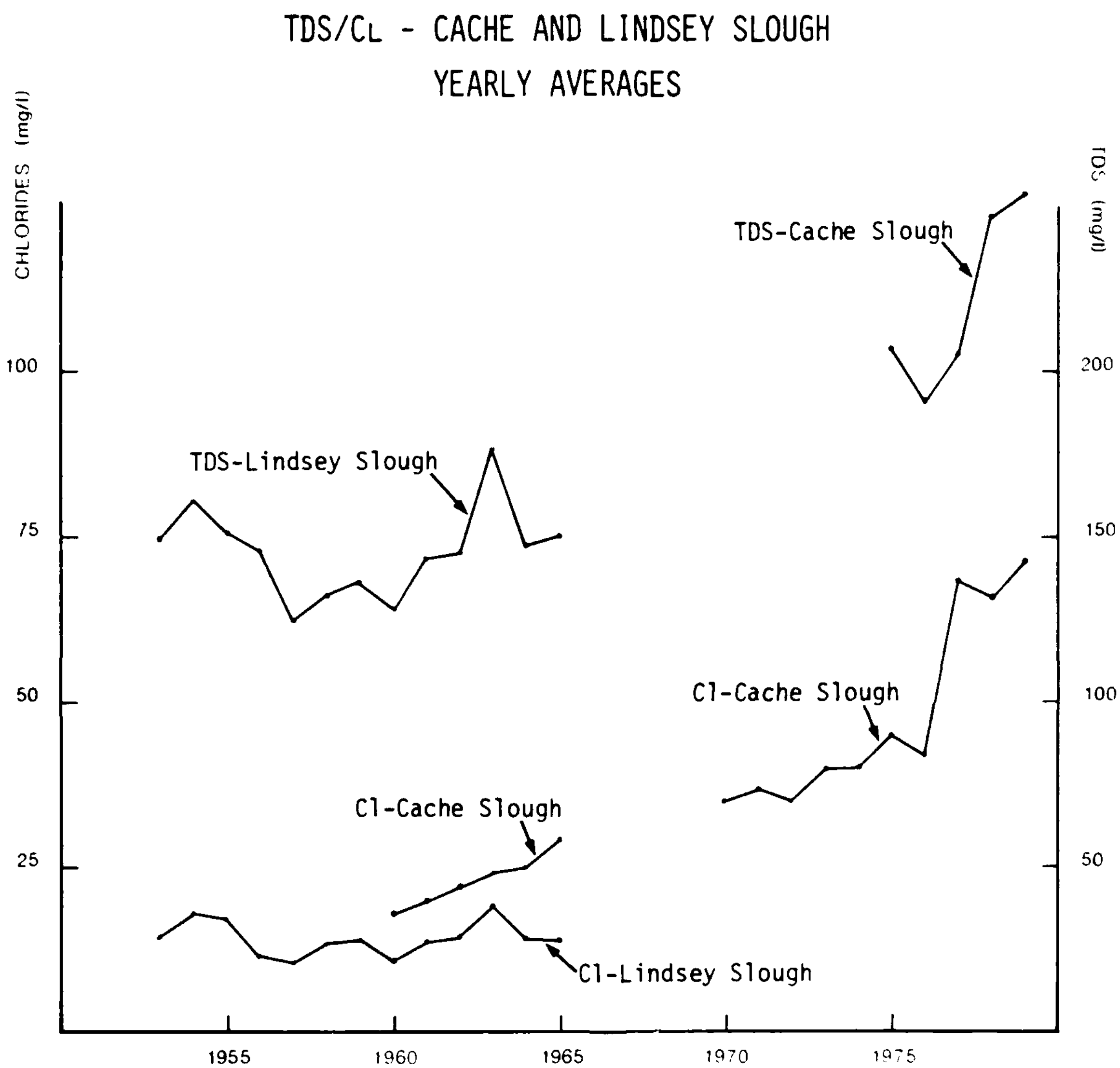


Figure 2 - Yearly average TDS and Chloride data for Lindsey Slough (1953-65) and Cache Slough (1960-65 and 1970-79)

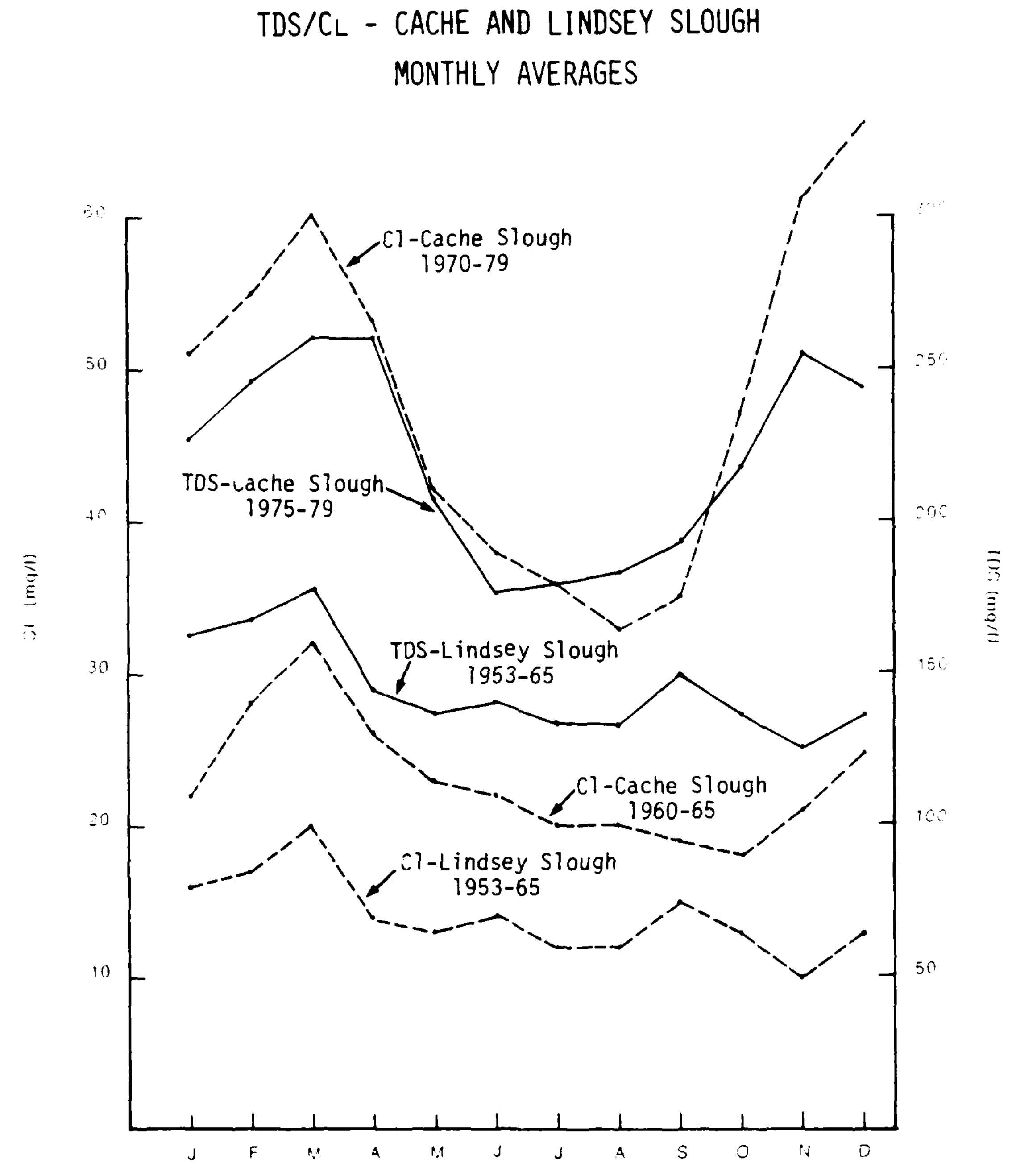


Figure 3 - Monthly averaged TDS and chloride data for Lindsey Slough (1953-65) and Cache Slough (1960-65 and 1970-79)

TABLE 4 - CACHE SLOUGH WATER QUALITY (SEPTEMBER 1979)

Parameter	Units	Cache Slough
Alkalinity - Tot.	$mgCaCO_{3/l}$	110
Bicarbonate	$mgCaCO_{3/l}$	110
Carbonate	$mgCaCO_{3/l}$	0
Hydroxide	$mgCaCO_{3/l}$	0
Total Organic Carbon	mg/l	7
Nitrate	mgN/l	0.7
	mg/l	< 0.1
Sulfate	mg/l	24
Surfacants (MBAS)	mg/l	< 0.07
Silica Reactive	mg/l	7.3
Arsenic	mg/l	0.006
Barium	mg/l	< 0.1
Cadmium	mg/l	< 0.005
Chromium	mg/l	0.01
Copper	mg/l	0.02
Iron	mg/l	2.1
Lead	mg/l	< 0.03
Manganese	mg/l	0.11
Mercury	μg/l	< 1
Potassium	mg/l	2.1
Selenium	mg/l	< 0.005
Silver	mg/l	< 0.02
Sodium	mg/l	22
Zinc	mg/l	< 0.006
2,4-D	ppb	0.2
2,4,5-TP	ppb	< 0.01
Endrin	ppb	< 0.01
Lindane	ppb	< 0.01
Methoxychlor	ppb	< 0.1
TICH	ppb	< 0.1
Toxaphene	ppb	< 0.1

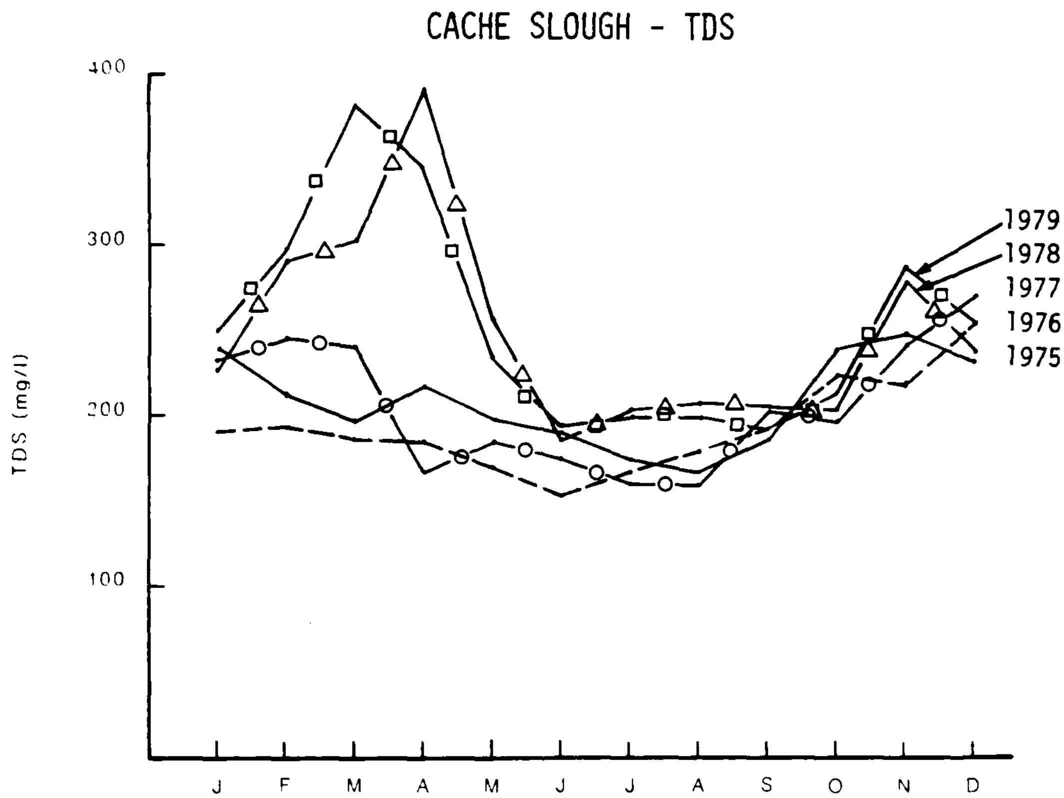


Figure 4 - Monthly averaged TDS data
for Cache Slough (1975-79)

constant concentration level over the total period. Seasonal variations (Figure 3) indicate the highest TDS and Chloride concentrations occur during the winter and spring months when precipitation and runoff are at peak levels.

In 1967, the Delta-Suisun Bay Pollution Investigation (DWR Bulletin No. 123) notea the mineral concentrations in Lindsey Slough are higher than the Sacramento River (at Rio Vista) because of poor quality groundwater seepage and irrigation return flows. A poor circulation pattern also contributes to the higher TDS and Chloride concentrations found in Lindsey Slough. In addition, the study indicated minimal hourly and daily fluctuations were observed in the TDS concentrations, therefore, the tidal excursions had little immediate effect on the quality of the water in Lindsey Slough.

Spatial variations can be evaluated using the data collected on the same day (June 10, 1968) at several locations in the region (Table 5). As suggested in the Table, the Chloride and estimated TDS concentrations increase as the sample stations move upstream. For example, samples collected from Cache Slough (above Liberty Island) show Chloride and estimated TDS concentrations of 14 and 166 mg/l, respectively. On the other hand, the upstream concentrations for Chlorides and estimated TDS were 29 mg/l and 225 mg/l, respectively, for Calhoun Cut and for Cache Slough (at Maine Prairie) 21 mg/l and 217 mg/l, respectively. These observations are confirmed by three measurements collected on October 1, 1979. The first measurement on Lindsey Slough (one mile above the Liberty Island Ferry) gave an estimated TDS concentration of 156 mg/l. The second measurement (2.8 miles above the Liberty Island Ferry) gave 164 mg/l and the third sample (5.2 miles above Liberty Island Ferry) measured 178 mg/l. Therefore, assuming negligible tidal effects, the water quality decrease in an upstream direction. These results appear reasonable considering the limited mixing and circulation occurring in the upstream areas and the combined effects of irrigation return flows and evaporation on the local mineral concentrations.

TABLE 5

GRAB SAMPLE EC, CHLORIDE AND TDS DATA FOR
VARIOUS STATIONS COLLECTED ON JUNE 10, 1968

Station No.[1]	Location	EC	CL	TDS[2]
2	Calhoun Cut	395	29	225
5	Cache Sl. @ Maine Prairie	362	21	217
6	Cache Sl. @ Vallejo P.P.	305	17	201
8	Haas Sl.	265	16	181
9	Cache Sl. Below Haas Sl.	260	16	178
10	Cache Sl. Above Shag Sl.	208	15	177
11	Lindsey Sl.	270	16	184
13	Cache Sl. Above Liberty Is.	238	14	166

[1]Refer to Figure 1

[2]Estimated EC 0-300 .55EC + 35
300-5100 .267EC + 120

Source: DWR
Cache Slough Vallejo Intake

The temporal and spatial variations observed in the available water quality data indicate the following general conclusions:

1. The water quality in Lindsey Slough may be slightly better than Cache Slough on a yearly average basis.

2. The water quality in Cache Slough may be decreasing at a more rapid rate than Lindsey Slough due to seasonal irrigation return flow and runoff conditions.

3. Water quality in both Lindsey and Cache Sloughs decrease during the winter and spring month when seasonal precipitation and runoff are highest.

4. The water quality in the region appears to have been affected by the 1976-77 drought period as reflected by the higher TDS and chloride concentrations found in Cache Slough.

5. The water quality in both Lindsey and Cache Sloughs decrease in an upstream direction reflecting the lack of mixing and circulation and the accumulation of mineral salts due to agricultural return flows and evaporation.

6. Tidal fluctuations appear to have no immediate effects on TDS and Chloride concentrations.

Hydraulic Characteristics

Very little hydraulic data is available for Lindsey or Cache Sloughs. Although limited tidal height data is available, channel flows and velocities have not been measured on a regular basis. A dye release study was conducted in Lindsey Slough during the summer of 1963 (DWR Bulletin 123) that indicated a slow but steady upstream movement of water due to agricultural withdrawals and domestic usage. Periodic diversions at the upper end of Lindsey Slough were estimated to range from 1 to 10 cfs. Agricultural returns were estimated to be 1 to 6 cfs. The results of numerical model runs conducted by DWR (Figures 5 and 6) indicate maximum simulated flood and ebb flows of, approximately, 2500 to 2200 cfs, respectively, for "normal" mid-summer hydrologic conditions (Figure 5). Under low flow, mid-summer hydrologic conditions, the model simulates maximum flood and ebb flows of, approximately, 2450 to 2100 cfs respectively. Integration of the flood and ebb flow rates over time provides an estimate of the average flow for each period. As indicated in Table 6, the total (time averaged) ebb and flood flows in Lindsey Slough are 1798 cfs and 2374 cfs, respectively, for low flow, mid-summer hydrologic conditions. This gives a net flood flow of 576 cfs during the tide cycle. The total (time averaged) ebb and flood flows for "normal" hydrologic conditions are 3343 cfs and 4223 cfs, respectively, giving a net flood flow of 447 cfs. The higher net flood flow estimated for the low flow hydrologic condition are, most likely, due to higher agricultural usage rates, evaporation and seepage to groundwater. It should be noted that, although the simulated flows seem reasonable, the model has not been calibrated in this region, therefore, the results should be considered as estimates only.

Cache Slough is fed by seasonal flows from Ulatis Creek, therefore, the hydraulic characteristics would be expected to be slightly different from those found in Lindsey Slough. The results of the numerical model simulations are presented in Figures 5 and 6. The maximum simulated flood and ebb flows for the "normal" hydrologic conditions (Figure 5) are 4700 cfs and 3800 cfs, respectively. Under low-flow hydrologic

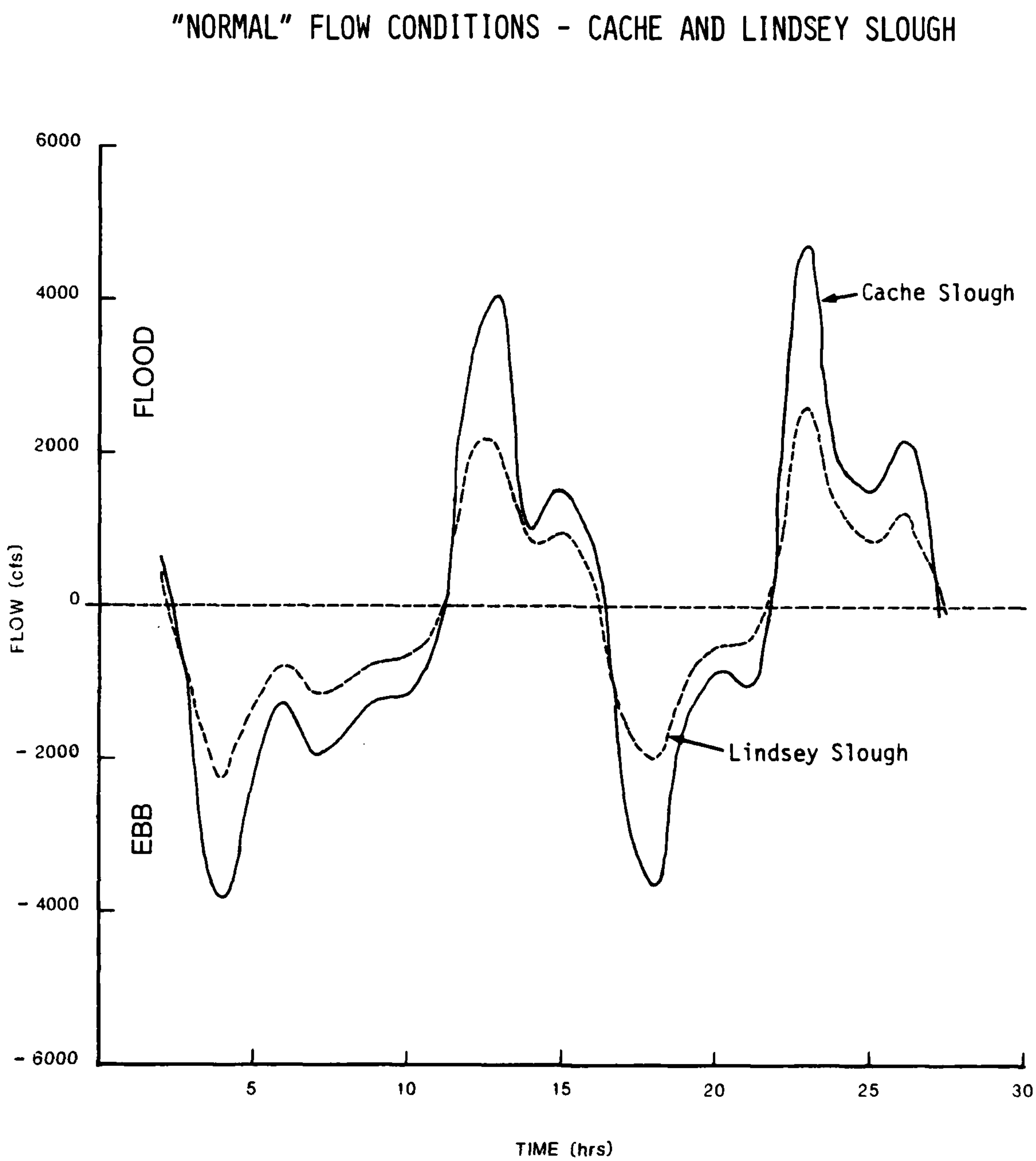


Figure 5 - Simulated hydraulic flow for Cache and Lindsey Sloughs under normal mid-summer hydrologic conditions (Aug. 25, 1968) simulated by DWR model

LOW FLOW CONDITIONS - CACHE AND LINDSEY SLOUGH

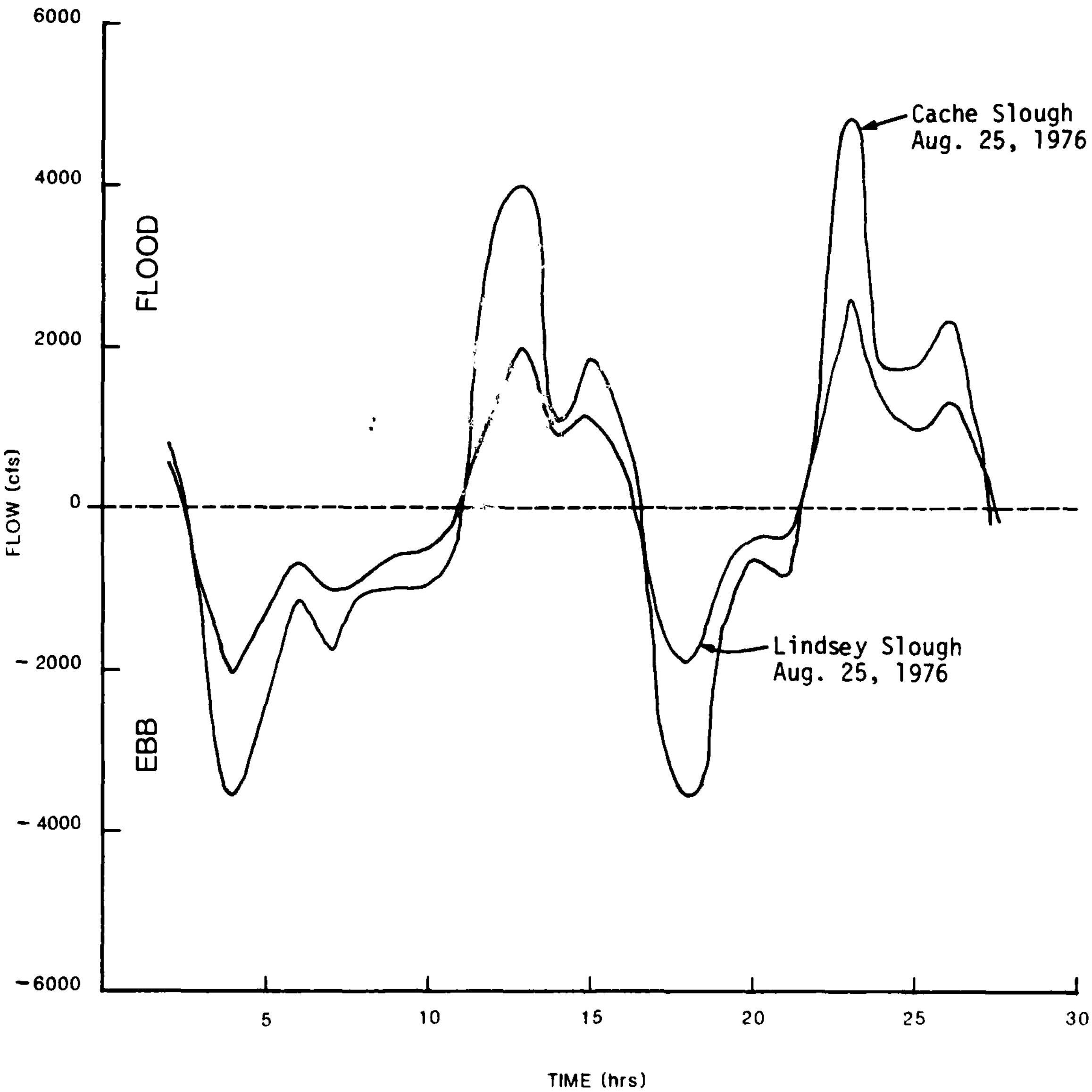


Figure 6 - Simulated hydraulic flow for Cache and Lindsey Sloughs under low flow, mid-summer hydrologic conditions (Aug. 25,1976)

TABLE 6

TIME AVERAGED FLOWS FOR CACHE AND LINDSAY SLOUGHS

	Flood Time		Ebb Tide		Net Flow
	Time (hrs)	Flow (cfs)	Time (hrs)	Flow (cfs)	Ebb-Flood (cfs)
Low Flow Hydrologic Conditions					
Lindsey Slough	5.4	1074	8.5	870	-204
	6.0	1300	5.1	928	-372
Total		2374		1798	-576
Cache Slough	5.4	2092	8.5	1565	-527
	6.1	2131	5.0	1780	-351
Total		4223		3345	-878
"Normal" Hydrologic Conditions					
Lindsey Slough	5.1	1171	8.6	985	-186
	5.9	1254	5.4	993	-261
Total		2425		1978	-447
Cache Slough	5.3	1887	8.8	1713	-174
	5.5	2255	5.4	1722	-533
Total		4142		3435	-707

conditions, the simulated maximum flood and ebb flows are 4800 cfs and 3600 cfs, respectively. The total integrated flood and ebb flow rates for Cache Slough are 4223 cfs and 3345 cfs, respectively for the low flow hydrologic conditions and 4142 cfs and 3435 cfs, respectively, for "normal" hydrologic conditions. The net (flood) flows are 878 cfs and 707 cfs, respectively, for the low flow and "normal" hydrologic conditions. As observed in Lindsay Slough, the simulated net flows in Cache Slough for the low-flow hydrologic conditions are slightly greater than found for the "normal" conditions.

On November 27-28, 1979, the Department of Water Resources conducted a flow measurement study in Cache Slough over a complete tide cycle. The integrated flood and ebb flows over the period were 735 cfs and 853 cfs, respectively, giving a net ebb flow of 118 cfs. The net ebb flow indicates a net downstream movement of the water mass for this tidal period.

Based on the available data, it is difficult to generate specific conclusions about the hydrologic characteristics of Cache and Lindsey Sloughs. However, several general observations can be made from the information that is available.

1. The general hydraulic characteristics of Lindsey Slough are slightly different from Cache Slough during the periods of heavy precipitation and runoff due to the runoff flows from Ulatis Creek into Cache Slough. However, during periods when Ulatis Creek is dry, both sloughs are essentially deadend water channels.

2. Flood and ebb flows in Lindsey Slough are slightly smaller than Cache Slough. The difference in flow rates probably reflects variations in agricultural and domestic usage, evaporation and groundwater seepage.

3. During peak usage periods, the net flow in both channels is upstream indicating losses to agricultural withdrawals, evaporation and seepage. However, during periods of precipitation and runoff, the net flows are in a downstream direction.

4. The difference in the flow rates between "normal" and low flow hydrologic conditions are relatively small suggesting that the hydraulic characteristics during these periods are similar for both normal and low flow hydrologic conditions. Greater variations in the hydraulic characteristics would be expected to occur between periods of "normal" precipitation and runoff and the low flow hydrologic conditions.

APPENDIX D

Reports of Rare and Endangered Species Survey

Interim Report

Floristic Reconnaissance of Proposed Routes for the North Bay Aqueduct

May 13, 1980

Prepared by: F. Thomas Griggs
and
Thomas H. Whitlow

DWR Contract # B-53552

A. Background

Between April and June of 1979, the authors investigated and described the flora and vegetation along the proposed alignment for the North Bay Aqueduct between Calhoun Cut and Denverton Creek in Solano County. The results of this study were reported to the Department of Water Resources on July 7, 1979 (A Floristic and Vegetation Survey of the Proposed North Bay Aqueduct). Subsequent to this study, several alternative alignments were selected in an effort to reduce the impacts on vernal pools and the area unofficially known as the Jepson Prairie. The current study examines the flora and vegetation of two alternative routes for the aqueduct.

Purpose

This interim report provides preliminary information about the occurence of vernal pools and rare plant species known to occur in the general vicinity of the proposed alignments. This information is being made available now to aid in the preparation of the Draft Environmental Impact Report. The study is being conducted in two phases. The first phase focuses on early blooming plant species while the second phase will deal with summer blooming species. Because the current study will not be completed until July, 1980, the interim report is necessarily incomplete. The final report will include species lists, maps and analyses which are not included here.

There are three goals of this study: 1) To locate populations of spring blooming plants which are designated as Rare, Endangered, or Candidate species by the U.S. Fish and Wildlife Serivce in accordance with the Rare and Endangered Species Act of 1973. The species of concern are: Downingia humilis, Lasthenia conjugens and Legenere limosa. 2) To locate areas where the proposed alignments cross vernal pools. 3) To locate areas where native perennial plants occur in the grasslands along the alignments. The presence of native perennial plants indicates a relatively low amount of disturbance of the native vegetation.

B. Methods and Findings

An initial reconnaissance of both proposed routes was conducted by car on April 4, 1980. Areas of relatively undisturbed native vegetation were located at all points where vehicular access was possible. On April 14, 1980, both routes were inspected by helicopter to locate natural vegetation which

was missed by the car reconnaissance. Areas where trespass rights had been granted by the owners were targeted for detailed on the ground inspections. Areas where access was not granted were not inspected any further.

1) Areas of Natural Vegetation Which Were Not Inspected

Only one area was not ground checked due to lack of trespass permission (the north half of the southeastern quarter of Section 6 of Township 5N, Range 2E). This parcel was found to include vernal pools, as evidenced by standing water and a conspicuous display of *Lasthenia* spp. The area was grazed by sheep in April, 1980. Approximately 0.4 miles of proposed alignment traverse this area.

2) Areas Inspected on Foot

Areas open to trespass were inspected by following a compass bearing through cross-country sections of the alignment. The right-of-way was assumed to extend approximately 50 feet to either side of the centerline. Where the alignment parallels Creed Road, the right-of-way was assumed to extend 100 feet south of the fence line, parallel to Creed Road.

Species lists were compiled for each pasture encountered. Pastures were identified by fence lines and were assumed to represent areas of uniform management.

Vernal pool censuses were conducted for each pasture using the following criteria:

a) Pools had to be within the 100 foot right-of-way.
b) Pools had to be reasonably natural and intact. For example, a man-made ditch with several vernal pool species growing in it would not be counted.
c) At least four vernal pool species had to be contained within an area in order to be counted as a pool.
d) A pool had to be a continuous unit. An amoeboid drainage would be counted as one pool rather than many.
e) A pool had to be relatively large, i.e., greater than 200 $feet^2$ in surface area.

These criteria are stringent and exclude small, disturbed, and depauperate pools. The number of pools reported should be regarded as a minimum.

Synopsis of Site Inspections

a) Alignment: Northern *

Location: Sections 2,3 and the SE $\frac{1}{4}$ of Section 4, Township 5N, Range 1E.

Distance: 2.8 miles

Date Inspected: April 16, 1980

Rare species: None encountered

Grassland perennials: Few and scattered

Vernal pools: 57, including one large hogwallow

Number of pastures: 4

Grazing: All pastures grazed by sheep

Comments: Includes some alkaline sinks at west end; grazing reduces the visibility of the vernal pools, but they are well defined.

b) Alignment: Southern

Location: N $\frac{1}{2}$ of Sections 34, 35 and 36, Township 5N, Range 1W

Distance: 2.4 miles

Date Inspected: April 27, 1980

Rare species: None encountered

Grassland perennials: Convolvulus sp.; none in flower, may be introduced; Brodiaea coronaria found

Number of pastures: 4

Grazing: 3 pastures by cattle, 1 pasture by sheep

Comments: Generally heavily grazed early in season, low cover in the grassland, vernal pools heavily trampled.

c) Alignment: Southern

Location: South section line (Parallel to Creed Road) of Sections 25, 26, 27, 28, 29, 30, Township 5N, Range 1E.

Distance: 6 miles

Date Inspected: April 27, 1980

Rare species: None encountered

Grassland perennials: Large stand of Stipa pulchra in Sections 31 and 32, scattered Wyethia angustifolia

*"Northern" Alignment is used to describe the route from Cache Slough, bypassing Travis Air Force Base on the north side.

Vernal pools: Several shallow pools and well-developed hogwallows

Number of pastures: 10

Grazing: Much of the area apparently ungrazed this season

Comments:
- NW $\frac{1}{4}$ of Section 33 freshly dished
- NE $\frac{1}{4}$ of Section 33 seeded to barley
- NE $\frac{1}{4}$ of Section 34 has well expressed hogwallows
- Section 36 seeded to oats
- Marsh habitat where Denverton Creek crosses Creed Road.

d) Alignment: Southern

Location: The Peterson Ranch, Section 28 and the south $\frac{1}{2}$ of Sections 29 and 30, Township 5N, Range 2E.

Distance: 3.6 miles

Date Inspected: May 2, 1980

Rare species: None encountered

Grassland perennials: Scattered Stipa pulchra

Vernal pools: Well-defined hogwallows in the SW $\frac{1}{2}$ of Section 29 and NW $\frac{1}{4}$ of Section 32

Number of Pastures: Approximately 4

Grazing: All pastures grazed this season

Comments: Lindsey Slough has well-developed riparian zone, including intertidal stands of Scirpus californicus (California tule).

Summarizing, while none of the recognized rare and endangered plants were found, vernal pools were encountered along both the northern and southern alignments. The degree of disturbance was far less along the northern route, and the number of well-defined vernal pools was greater. With the exception of the Stipa grassland in Sections 31 and 32 and the hogwallows in Section 34, the southern route crosses highly disturbed vegetation which is inferior as natural vegetation to that found on the northern route.

FINAL REPORT

Possible Occurrence of Endangered and Threatened Species of Plants and Animals along the Proposed Alignments of the North Bay Aqueduct

November 21, 1980
Prepared by: F. Thomas Griggs
and
Thomas H. Whitlow
DWR Contract # B-53552

INTRODUCTION

This is the second and final report to the California Department of Water Resources regarding the habitat and possible occurrence of rare and endangered plant and animal species along two proposed alignments for the North Bay Aqueduct. The Interim Report submitted in May 1980, describes the occurrence of vernal pools and perennial grasslands along the alignments. This report focuses on the habitat requirements of 13 listed and candidate species recognized by the U.S. Fish and Wildlife Service under the Endangered Species Act of 1973. A floristic checklist of the plants occurring along the alignments is also included.

METHODS

The spring floristic reconnaissance was conducted along both alignments in April and May 1980 (See Interim Report). Subsequent visits to specific locations were made in June, September, and October 1980 to locate plant species not conspicuous during the spring season.

To ascertain the habitat requirements of rare species, appropriate literature was collected and knowledgeable scientists and administrators were contacted. Suitable habitat for the three rare animals was identified on the basis of information obtained from these sources.

Trapping or deliberate hunting for the animal species (a beetle, snake, and mouse) was not deemed appropriate for determining probable occurrence. Species occurrence fluctuates over time, whereas habitat remains more constant. By focusing on habitat, it is possible to state whether suitable areas occur or do not occur. In contrast, focusing on individuals (i.e., by hunting for them) provides reliable information only if the species is caught.

FINDINGS AND IMPACTS

The following discussion describes the probable occurrence of 13 rare species along the alignments and the likely impact of the project on these species.

Plants

Species Name: ORCUTTIA MUCRONATA (Solano Grass).

Code: ORMU

Legal Status: Listed Endangered

Habitat: Known to grow only on the dryed summer bed of a vernal lake southwest of Dozier Station, Solano County.

Habitat Occurrence: Neither right of way transects a vernal pond or lake large and deep enough to support this Orcuttia.

Species Name: ASTER CHILENSIS var. LENTUS (Suisun Aster)

Code: ASCHL

Legal Status: Candidate

Habitat: Brackish marshes around Suisun Bay and inland a short distance along the Sacramento River.

Habitat Occurrence: The only point where the southern right of way transects brackish marsh is southeast of Cordelia. A site visit on 12 June 1980 revealed no ASCHL growing along the right of way. This portion of the marsh has been altered by levee and road construction for farming and hunt clubs.
The nearest collection of ASCHL to the right of way is recorded as south of Suisun City.

Species Name: CIRSIUM HYDROPHILUM ssp. HYDROPHILUM (Suisun Thistle)

Code: CIHYH

Legal Status: Candidate

Habitat: Brackish marshes around Suisun Bay

Habitat Occurrence: The marshes southeast of Cordelia are the only habitat along the southern right of way likely to support CIHYH. However, the right of way crosses through an area previously disturbed by road and levee construction. No CIHYH was found along the right of way southeast of Cordelia. The nearest collection of CIHYH to the right of way is south of Suisun City near Peytonia Slough.

Species Name: CORDYLANTHUS MOLLIS ssp. MOLLIS (Soft birds-beak)

Code: COMOM

Legal Status: Candidate Threatened

Habitat: Salt marshes around the north portion of San Francisco Bay.

Habitat Occurrence: The marshes southeast of Cordelia are closest to the likely habitat of COMOM. However the portion traversed by the right of way is heavily disturbed and COMOM was not observed. The nearest collection site is reported only as 'south of Suisun City'.

Species Name: CORDYLANTHUS MOLLIS ssp. HISPIDUS (Hispid birds-beak)

Code: COMOH

Legal Status: Candidate Threatened

Habitat: Alkaline soil in grassland

Habitat Occurrence: One extant population of COMOH grows at the head of Denverton Creek along the southeast shoreline of the vernal lake in the $S\frac{1}{2}$ of Section 29 T5N R1E. The south r ight of way is less than 100 feet from this population, across Creed Road to the south. However, the plant could not be found along the right of way. Aqueduct construction within the proposed right of way south of Creed Road would likely not impact upon COMOH. However, should the vernal lake basin be dammed and the water level raised above natural levels, the COMOH may be adversely affected.

Species Name: LASTHENIA CONJUGENS (Contra Coasta baeria)

Code: LACO-3

Legal Status: Candidate endangered

Habitat: Vernal pools of Solano and Contra Costa Counties

Habitat Occurrence: Significant areas of vernal pools are traversed by the two right of ways (See discussion in Interim Report). However, diligent search for LACO-3 could find none along the right of way. Collection sites near the right of way include: 'along Hwy. 12, 6 miles east of Fairfield - this site is less than 1 mile south of the southern right of way; 2 miles north of Vanden Station - less than one mile north of the northern right of way, although much of this area has been plowed recently.

Species Name: LATHYRUS JEPSONII ssp. JEPSONII (Delta-Tule pea)
Code: LAJEJ
Legal Status: Candidate Endangered
Habitat: Brackish marshes, Suisun and San Pablo Bays
Habitat Occurrence: Only the marshes southeast of Cordelia offer potential habitat. The right of way crosses the marsh in an area already heavily disturbed by roads and levees. No LAJEJ was observed along the right of way. The nearest collection of the LAJEJ to the right of way is south of Suisun City near Peytonia Slough.

Species Name: LEGENERE LIMOSA (Legenere)
Code: LELI
Legal Status: Candidate endangered
Habitat: Vernal pools of the Central Valley; rarely collected. A specimen of LELI was studied at the Botany Dept. Herbarium, UC Davis.
Habiatat Occurrence: LELI was not seen in any of the vernal pools along the right of way. The nearest collection to the right of way is from Calhoun Cut at the Hwy. 113 bridge.

Species Name: LILAEOPSIS MASONII (Mason's lilaeopsis)
Code: LIMA-5
Legal Status: Candidate endangered
Habitat: Brackish marshes and flats around Suisun Bay and inland along the Sacramento River for a short distance.
Habitat Occurrence: Only the marshes southeast of Cordelia offer the potential habitat. However, the portion traversed by the right of way has been severely disturbed by levee and road cobstruction. The nearest collection of LIMA-5 to the right of way is south of Suisun City near Peytonia Slough.

Species Name: NEOSTAPFIA COLUSANA (Colusa grass)
Code: NECO
Legal Status: Candidate endangered
Habitat: The dried summer bed of large vernal ponds and lakes.
Habitat Occurrence: No vernal ponds of sufficient size or depth occur along the right of way. The nearest population of NECO is found in the vernal lake southwest of Dozier Station.

Species Name: TRIFOLIUM AMOENUM (Two-fork clover)

Code: TRAM

Legal Status: Candidate endangered

Habitat: Low marshy areas in grassland.

Habitat Occurrence: Possibly at marshy areas near Lindsey Slough or Denverton Creek, although TRAM was not found along the right of way. The nearest collection is reported as from Elmira, several miles north of the northern right of way.

Species Name: DOWNINGIA HUMILIS (Delta downingia)

Code: DOHU

Legal Status: Candidate

Habitat: Well developed (deep) vernal pools.

Habitat Occurrence: While many areas of vernal pools are crossed by the right of ways, DOHU was not found along the right of ways. The nearest known collection sites are from the shore of the vernal lake southwest of Dozier Station and from vernal pools around the head of Calhoun Cut, ca. ½ mile north of Creed Road.

Animals

Species Name: THAMNOPHIS COUCHI GIGAS (Giant garter snake)

Code: THCOG

Legal Status: Candidate

Habitat: This is one of the most aquatic of all garter snakes, found only in areas of permanent fresh water (sloughs and marshes).

Habitat Occurrence: The only areas with permanent fresh water are at the east end of each right of way: Lindsey Slough and Cache Slough. (The marshes southeast of Cordelia are not suitable since they contain brackish or salty water). Installation and operation of pumping stations at either Lindsey Slough or Cache Slough would likely have minimal impact on this snake since the slough would not be altered.

Species Name: REITHRODONTOMYS RAVIVENTRIS HALICOETES (Salt-marsh harvest mouse)

Code: [illegible]

Legal Status: Listed endangered

Habitat: Salt-marshes supporting a continuous stand of Salicornia (pickleweed)

Habitat Occurrence: The marshes southeast of Cordelia are likely to support [illegible]. Indeed, Fisler (1965) reports Cordelia as a collection site for [illegible]. However, the right of way through the marsh transects severely altered terrain (levees and roads). There is no Salicornia along or near the right of way. One-quarter mile north of the right of way and immediately north of the railroad bed is a Salicornia marsh. This may be the collection referred to by Fisler. Since [illegible] is found only in continuous Salicornia marsh, the likelihood is remote of finding any [illegible] along the right of way.

Species Name: ELAPHRUS VIRIDIS (Delta Green Ground Beetle)

Code: ELVI

Legal Status: Proposed threatened

Habitat: The delta green ground beetle inhabits the cracks in the soil bordering two large vernal lakes in Solano County. An extensive search failed to locate other populations in the vicinity (Andrews 1978).

Habitat Occurrence: Critical habitat has been proposed by the U.S. Fish and Wildlife Service (see map) and an environmental assessment has been prepared. This habitat is located between the the north and the south right of ways and within ¼ mile of the northern right of way.

CONCLUSIONS

None of the 10 plant species considered in this investigation were found on either of the right of ways. Both alignments traverse habitat suitable for Lasthenia conjugens and the southern right of way comes within 100 feet of a known population of Cordylanthus mollis var. hispidus. Suitable habitat for the other species of plants is not close enough to the alignments to warrant any special consideration during construction.

Of the animal species, no suitable saltmarsh habitat exists along the alignments for the salt-marsh harvest mouse. Habitat for the delta green ground beetle has been precisely delineated by recent investigation and is not crossed by either alignment. The giant garter snake requires permanent fresh water. The only possible sites satisfying this requirement occurs at the intakes at Lindsey and Cache Sloughs. Unless the construction and operation of the aqueduct affects the perenniality of these water bodies, the habitat would probably not be affected.

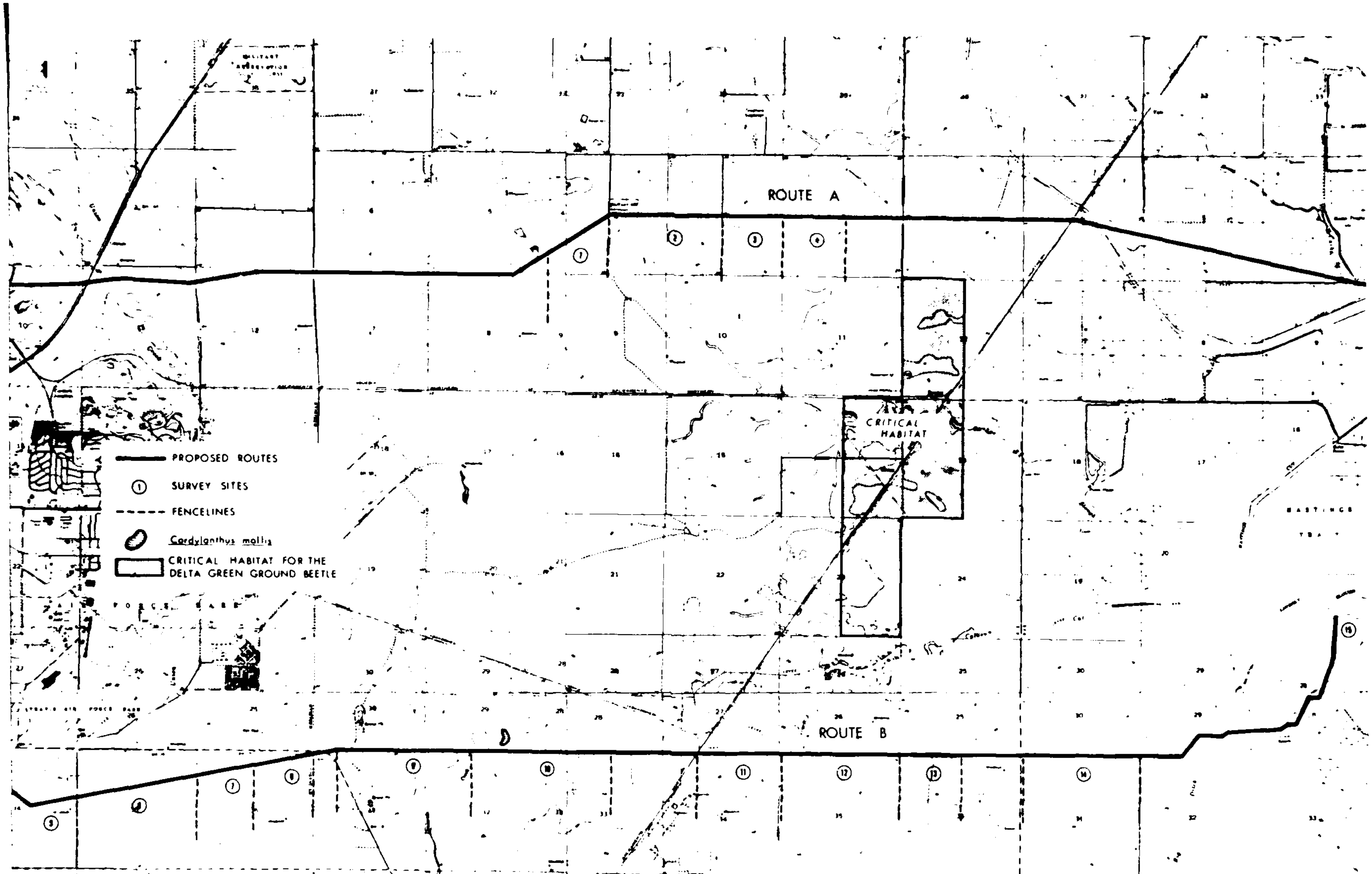
LITERATURE

Andrews, F.G. 1978. Unpublished report on the status of Elaphrus viridis. California Dept. of Food and Agriculture, Sacramento.

Fisler, George E. 1965. Adaptation and specieation in the harvest mice of the marshes of San Francisco Bay. Univ. of Calif. Pub. in Zoology, Vol. 77.

Smith, J.P. et al. 1980. Inventory of Rare and Endangered Vascular Plants of California. Special Pub. No. 1 (2nd edition), California Native Plant Society, Berkeley.

——— Status report on the giant garter snake (Thamnophis couchi gigas). California Dept. of Fish and Game. From the files of the Calif. Natural Diversity Data Base.



Proposed Alignments: North Bay Aqueduct (Map by T. H. Whitlow, 10/80)

Floristic Checklist for the Proposed Alignments, Spring, 1980

Amaryllidaceae
- *Brodiaea hyacenthina*
- *Brodiaea pulchella*

Boraginaceae
- *Allocarya* spp.

Callitrichaceae
- *Callitriche* sp.

Campanulaceae
- *Downingia concolor*
- *Downingia insignis*
- *Downingia pulchella*

Caryophyllaceae
- *Cerastium* sp.
- *Silene* sp.
- *Spergularia rubra*

Chenopodiaceae
- *Salicornia virginica*

Compositae
- *Achyrachaena mollis*
- *Blenosperma nana*
- *Cotula coronopifolia*
- *Hemizonia* sp.
- *Hypochoeris glabra*
- *Lactuca* sp.
- *Lasthenia chrysostoma*
- *Lasthenia fremontii*
- *Lasthenia glaberrima*
- *Lasthenia glabrata*
- *Layia fremontii*
- *Psilocarpus brevissimus*
- *Psilocarphus tenellis*
- *Silybum marianum*
- *Sonchus* sp.
- *Tragopogon* sp.

Convolvulaceae
- *Convolvulus* sp.

Crassulaceae
- *Tillaea aquatica*

Cruciferae
- *Brassica nigra*
- *Lepidium* sp.

Cyperaceae
- *Carex* sp.
- *Eleocharis macrostachya*
- *Scirpus californicus*
- *Scirpus olneyi*

Euphorbiaceae
- *Eremocarpus setigerus*

Gentianaceae

- *Cicendia quadrangularis*

Geraniaeae

Erodium botrys
Geranium dissectum

Gramineae

Alopecurus howellii
Avena barbata
Avena fatua
Briza minor
Bromus diandrus
Bromus mollis
Deschampsia danthonioides
Distichlis spicata
Elymus sp.
Gastridum ventricosum
Hordeum depressum
Hordeum geniculatum
Hordeum leporinum
Lolium multiflorum
Phalaris limonii
Pleuropogon sp.
Sporobolus
Stipa pulchra
Vulpia sp.

Iridaceae

Sisyrinchium sp.

Juncaceae

Juncus bufonius
Juncus capitus
Juncus sp.

Labiatae

Pogogyne zigyphoroides
Stachys sp.

Leguminosaeae

Lupinus bicolor
Lotus sp.
Robinia pseudoacocia
Trifolium depanperatum
Trifolium sp. 1
Trifolium sp. 2
Vicia sp.

Liliaceae

Lilaea scilloides

Limnanthaceae

Limnanthes douglasii var. rosea
Limnanthes alba

Lythraceae

Lythrum hypsopifolia

Malvaceae

Malva parviflora
Sidalcea sp.

Oleaceae

Fraxinus californicus

Plantaginaceae

Plantago hookeriana

Polemoniaceae

Navarretia sp.

Polygonaceae

Rumex crispus

Portulacaceae

Montia perfoliata

Salicaceae

Salix goodingii
Salix hindsiana
Salix lasiolepis

Scrophulariaceae

Mimulus tricolor
Orthocarpus attenuatus
Orthocarpus erianthus

Typhaceae

Typha latifolia

Umbelliferae

Eryngium vaseyi
Foeniculum vulgare
Sanicula sp.

Violaceae

Viola pedunculata

APPENDIX E

CULTURAL RESOURCES EVALUATION OF THE NORTH BAY AQUEDUCT ALIGNMENT ALTERNATIVES (ROUTES 1, 4 AND 6), SOLANO COUNTY, CALIFORNIA

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August 1980

SUMMARY

In late July/early August 1980, a Cultural Resources Evaluation was accomplished for the North Bay Aqueduct Project Alignment Alternatives (Routes 1, 4 and 6). The resources evaluation consisted of archival review, personal contact with local archaeologists and Native Americans, and complete archaeological field surveys of the three alternative routes. It was determined that the overall project area is rich in both prehistoric and historic cultural history and that numerous cultural resources are located throughout the region.

The cultural resources investigations resulted in the detection of three resources which are located within alignment corridors. The resources are as follows:

- A prehistoric archaeological site (CA-Sol-268), which is situated within the alignment section common to all three alternative routes, located west of Interstate 80.

- An historic feature, identified as a late 19th century stone fence, which is also situated within the alignment section common to the three routes, west of Interstate 80.

- An historic archaeological site, which is situated within the alignment section common to Alternative Routes 4 and 6, located between Interstate 80 and Suisun City.

It has been determined that these three cultural resources are potentially subject to direct adverse impacts resulting from project implementation. Several alternative courses of action are presented which would constitute acceptable mitigation concerning the potential impacts. In all cases, preservation and protection of the resources is strongly recommended.

The preferred project alignment from a cultural resources perspective would be Route 1; utilization of Route 1 would potentially impact only two known cultural resources, as opposed to three resources if Route 4 or 6 is utilized.

NOTE: Due to the confidential nature of some of the information contained in this report, several sections (maps, appendices, etc.) have been deleted. Uncontrolled access to specific information concerning the location of archaeological sites could result in damage (through acts of vandalism and/or illegal excavation) to these resources. Qualified individuals wishing to review the complete report should contact the State Archaeological Site Survey Regional Office at the Sacramento State University.

TABLE OF CONTENTS

INTRODUCTION

The nature of the project was briefly defined in 1979 as follows:

> The purpose of the proposed North Bay Aqueduct is to convey California Water Project water from the Sacramento-San Joaquin Delta overland to the counties of Napa and Solano. The 105 cubic feet per second (cfs) capacity aqueduct would deliver 20,500 acre-feet of water to Napa County and 36,400 acre-feet of water to Solano County (total 56,900 acre-feet) annually for municipal and industrial use. Various alignments are under consideration. All run east to west across Solano County to a point near Cordelia Junction, where an existing segment of the North Bay Aqueduct (Phase I) begins. This segment, a pipiline, has served the City of Napa on an interim basis since 1968 with water obtained from the Federal Solano Project. Final design of facilities for Phase II is not yet firm. All presently proposed alternatives, however, would require construction of water intake pipes below historic low water and an adjacent pumping plant at Lindsey Slough or Cache Slough about 16 miles east of the City of Fairfield. The water would then be conveyed to the existing Cordelia Surge Tank, which is part of the Phase I facilities. The proposed Travis Pumping Plant would not be required if only pipelines are used (Corps of Engineers, Public Notice, December 3, 1979).

In February 1980, a preliminary Cultural Resources Evaluation was prepared to determine the relative sensitivity of the seven project alignments under consideration at that time, for the North Bay Aqueduct Project. That phase of the North Bay Aqueduct Cultural Resources Investigation consisted of a general overview of the project area (i.e., literature review; personal communications with local cultural resources authorities and organizations, including Solano County Native Americans; and some cursory field inspection of the alternative project locations). The resource data which resulted from the preliminary study was utilized to determine the relative sensitivity of the then considered seven alternative alignments.

Based on various environmental and engineering factors, the number of considered alignments was reduced to three; in July 1980 Madrone Associates authorized the consultant to conduct a comprehensive Cultural Resources Evaluation of the three alignment alternatives. The project study areas are defined as follows:

- Route 1 consists of a study corridor which is approximately 30 miles in length and 80 to 90 feet in width (which includes maximum construction disturbance area). This alignment alternative is depicted on Maps 1

through 5. The water conveyance system would consist of a buried pipeline 60" in diameter. Also included in this route are several supplemental facilities, as follows:

- A pump station to be located on a one acre site, situated at the Cache Slough Intake (Map 1).
- A surge tower to be located on a 0.15 acre site, situated approximately one mile east of the Union Creek and Southern Pacific Railroad intersection on the corridor alignment (Map 2).
- A reservoir to be located on a 15 acre site, situated approximately 0.4 mile northeast of Green Valley Road and approximately 0.8 mile north of Cordelia Junction, on the corridor alignment (Map 5).

- Route 4 consists of a study corridor which is approximately 28 miles in length and 80 to 90 feet in width (which includes maximum construction disturbance area). This alignment alternative is depicted on Maps 5, 6, 7, 9 and 10. The water conveyance system would consist of a buried pipeline, 60" in diameter. Also included in this route are several supplemental facilities, as follows:

    - A pump station to be located on a one acre site, situated at the Lindsey Slough Intake (Map 6).
    - A surge tower to be located on a 0.15 acre site, situated approximately 0.8 mile west of Denverton Creek, on the study corridor alignment (Map 7).
    - A pump station to be located on a one acre site, situated approximately 200 feet east of Union Creek and 0.6 mile north of Highway 12, on the corridor alignment (Map 9).
    - A reservoir to be located on a 15 acre site, situated approximately 0.4 mile northeast of Green Valley Road and approximately 0.8 mile north of Cordelia Junction, on the corridor alignment (Map 5).

- Route 6 parallels the Route 4 study corridor, with the exception of an approximately two mile variation which is approximately 100 feet in width (Map 7). The water conveyance system would consist of an open canal from Lindsey Slough to a location immediately south of Travis AFB, followed by a buried pipeline (60" diameter) to a terminal reservoir near Cordelia. Supple-

mental facilities for this alignment would include a pumping station south of Travis AFB covering approximately one acre (Map 7).

CULTURAL RESOURCES BACKGROUND

This phase of the subject evaluation was accomplished by conducting a detailed review of records, maps and relevant cultural resources documents which identify and discuss the resources in the general environs of the project alignments. This archival review was primarily accomplished at the State Archaeological Site Survey/State Historic Preservation Regional Office at Sacramento State University. Also, other institutions, libraries and agencies were consulted as required. In addition to these efforts the National Register of Historic Places (1979), the California Inventory of Historic Resources (1976), the California Inventory of Historic Landmarks (1979) and the Central Solano County Cultural Heritage Commission Preservation Plan (1977) were consulted.

An integral aspect of gathering relevant cultural resources information is the consultation with local Native Americans concerning sites, features and locations within the study region which are culturally sensitive. Organizations and individuals from the Solano County area were consulted regarding these matters (see Appendices A and B for details).

These research efforts resulted in the following Cultural Resources Setting summaries.

Ethnographic Setting

According to traditional anthropological sources (Kroeber, 1925; Bennyhoff, 1950 and 1977; Johnson, 1978) the general project setting is within the territory controlled by the Penutian speaking Patwin peoples. At one time the Patwin Indians occupied the southern portion of the Sacramento River Valley to the west of the river, from the present town of Princeton south to San Pablo and Suisun Bays (Johnson, 1978). Bennyhoff (1977) identifies the group which occupied the study area as the Southern Patwin and places their eastern boundary approximately ten miles west of the Sacramento River and their western boundary in the vicinity of the Napa River (see Figure 1). The general Patwin region was occupied by many distinct groups which have been referred to in traditional anthropological literature as tribes or tribelets; the identification of these tribal groups was based on distinquishable dialects, i.e., Kabalmem, Cache Creek, Cortina, Tebti (Hill Patwin); Colusa and Grimes (River Patwin); Knight's Landing and Suisun (Whistler, 1976; Johnson, 1978 - see Figure 2).

In general, the Patwin territory extended from north to south for approximately ninety miles and from east to west for approximately forty miles. It can be divided into three physiographic regions from east to west as follows:

- The banks of the Sacramento River and its attendant dense tree, brush and vine vegetation interspersed with extensive tule marshes

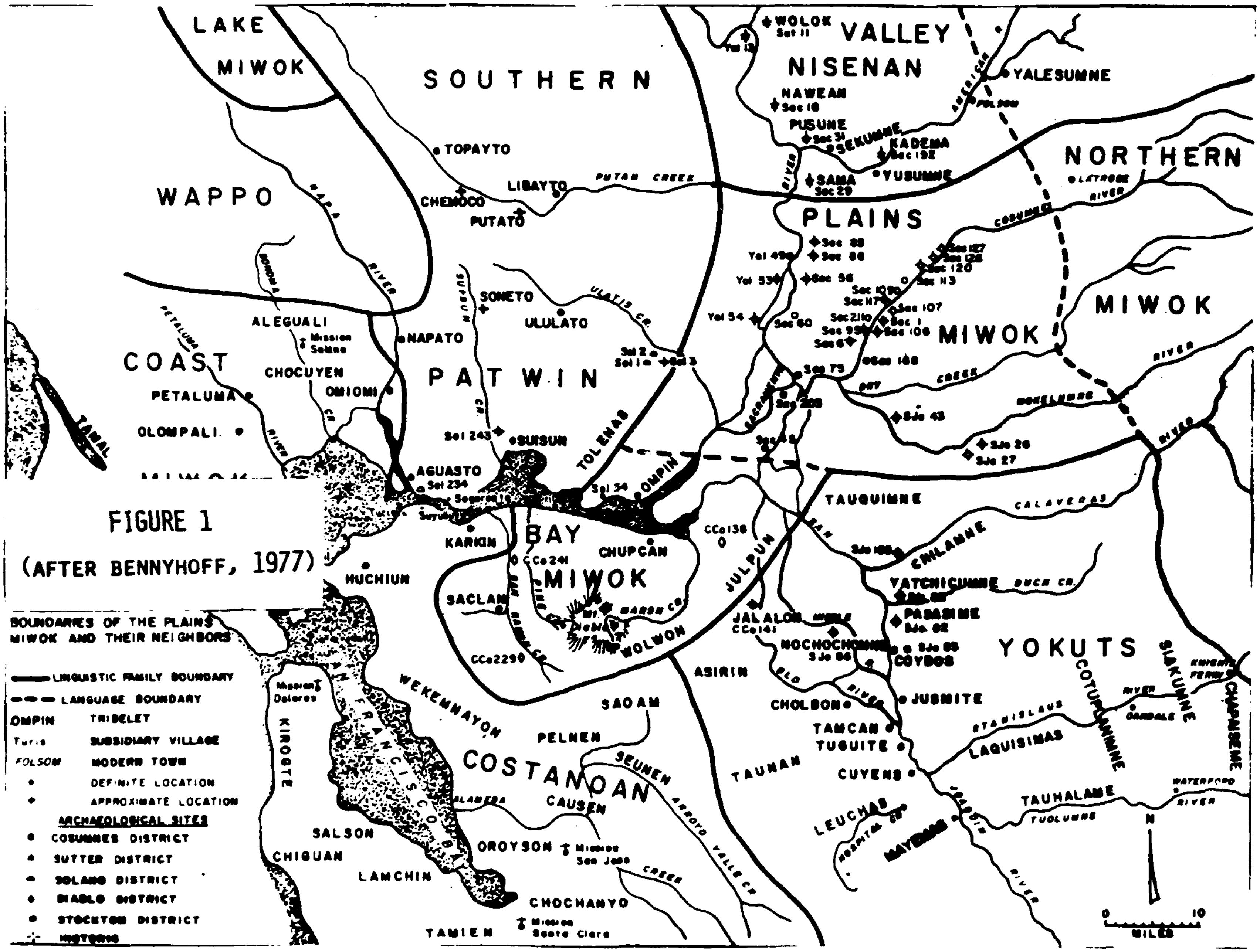


FIGURE 1

(AFTER BENNYHOFF, 1977)

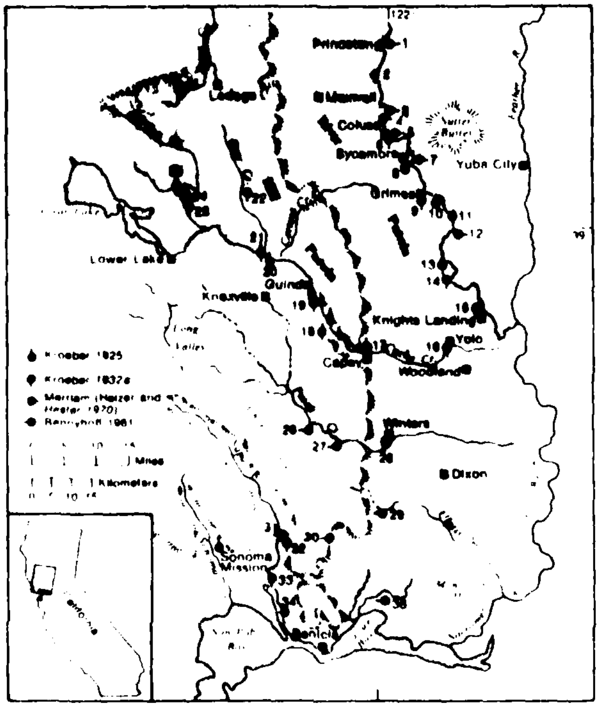


Fig. 1. Tribal territory and villages. 1. Bo'-do; 2. Katsil (*kac'il*), 3. Si-ko-pe, 4. Til-til; 5. Dok'-dok, 6. Koru; 7. No'pah; 8. Gapa, 9. P'ālo, 10. Nawidihu; 11. Kusêmpu; 12. Koh'pah de'-he; 13. unknown, 14. unknown; 15. Yo'doi, 16. Ch[illegible], 17. Moso, 18. Kisi, 19. Imil, 20. Lopa; 21. Tebti; 22. Sukui; 23. [illegible]o'lokomi; 24. Tokti, 25. Tebti, 26. Chemocu, 27. Putato, 28. Liwai, 29. Ululato; 30. Soneto, 31. Napato, 32. Tulukai; 33. Suskol; 34. Aguasto, 35. Tolenas. Village names after Kroeber 1925; Kroeber 1932a, Merriam (Heizer and Hester 1970), Bennyhoff 1961.

FIGURE 2

(AFTER JOHNSON, 1978)

- The flat open grassland plains with intermittent creeks and occasional oak groves.

- The lower hills of the eastern Coast Range Mountain slopes rising to an elevation of approximately 1400 feet.

Most of the pre-contact Patwin population was concentrated along the Sacramento River in large villages. Because much of the plains were submerged from floodwaters in the winter, and were relatively dry in the summer, occupation of the plains was sparse and seasonal. Tribal groups in the hill areas lived in the numerous valleys, particularly along the drainages of Cache and Putah Creeks (Kroeber, 1932; Johnson, 1978:351).

The main political unit of the Southern Patwin was the autonomous tribelet, which consisted of one primary and several satellite villages, all located within a well-defined territory. Each village had a chief who presided over resource procurement and ceremonial activities (Johnson, 1978:354).

Fishing, plant gathering and hunting formed the basis of the Southern Patwin economic system. Salmon, steelhead trout and other fish were caught by weir or net. Mussells were gathered from riverbeds. Deer, tule elk, small mammals, waterfowl and reptiles were hunted or trapped. Sunflower, alfilaria, clover, bunch grass and wild oat, all growing on the open plains, provided seeds that were parched or dried then pounded into a meal (Johnson, 1978).

As was common to many other California Indian groups, a primary staple was the acorn. Two types of Valley Oak acorns, hill and mountain oak, were usually gathered. Oak groves are believed to have been communally owned by the tribelets. Other food sources gathered were the buckeye, pine nuts, juniper berries, manzanita berries, blackberries, wild grapes, brodiaea bulbs and tule roots. Each village had its own locations for gathering these various resources, and the village chief was in charge of assigning particular families to collection areas (Johnson, 1978:355).

Four types of permanent structures were constructed within the Patwin tribal village. The dwelling or family house was located anywhere within the village; the ceremonial dance house was built at a short distance to the north or south end of the village; the sweathouse was located to the east or west of the dance house; and the menstrual hut was placed at the edge of the village, farthest from the dance house. All of these were earth-covered, semi-subterranean structures, either elliptical or circular in form. With the exception of the family houses, which were built by one's paternal relatives, the structures were built by everyone in the village (McKern, 1923; Kroeber, 1932).

Trade with neighboring Indian groups was an important aspect of Patwin economic and subsistence activities during prehistoric times; cultural contact and exchange was maintained with neighboring groups through the extensive trade networks. The Southern Patwin traded salmon, river otter pelts, game, cordage, sinew-backed bows, feathered headbands and shell beads to Pomo, Central Wintun, Wappo and Southern Maidu groups (Davis, 1974:34-35).

One of the most distinctive aspects of Patwin culture was the Kuksu religious system. A main feature of the cult was the occurrence of one or more secret societies, each with its own series of dances and rituals. Membership was by initiation, and such initiation was generally limited to boys from 8 to 16 years of age. In the Central California cult system, almost all Indian groups possessed the Kuksu, however, only the Patwin also had both the ghost and Hesi types (Kroeber, 1932). The purpose of each secret society was slightly different from the others, although somewhat overlapping. The ghost type, called "way sultu" (Northern Spirits) stressed the initiation ceremonies; the Kuksu emphasized curing and shamanistic functions; and the Hesi elaborated on ceremonial dancing. These secret societies became active within village life, depending on when boys in the villages were ready to be initiated and not upon any fixed seasonal or sequential schedule (Johnson, 1978:353).

The most complete information on Patwin mythology was collected by Kroeber (1932), who recorded twelve tales. The origin and other myths generally relate the interaction of anthropomorphized animals with humans (Johnson, 1978).

For further information concerning the various aspects of Patwin culture, reference is given to the various anthropogical sources which have been cited.

The Southern Patwin were dislocated immediately following Spanish contact and great numbers of these people were forced into subjugation at the missions. With the influx of Mexican Period populations in the early 1800s, and eventual settlement by Americans during the mid-1800s, the Patwin way of life was both purposefully and indirectly undermined. The arrival of whites, with their livestock and farms, caused the Patwin ecological balance to be greatly upset; food sources formerly available became extinct or scarce or otherwise unavailable. The accumulative effect of European and American influx into that territory resulted in the total displacement of their culture.

It is known that the Patwin Indian presence in the subject area was extensive during pre-contact times. The most widely accepted calculation, based in part on the baptismal records of the Bay Area missions, is that approximately 2300 Patwins were living in that region at the time of European contact (Cook, 1943). Today it is difficult to find anyone

in the area who is of Patwin ancestory or has oral knowledge of the Patwin way of life (see Appendix B).

A review of tradition ethnographic sources (which have been referenced) and consultation with Native American organizations and individuals (see Appendix B) suggests that no presently known or recorded ethnographic sites, locations or features which are culturally sensitive are located within the project study corridors. Several recorded ethnographic village sites are recorded within the general project environs, however none are located close enough to any of the three alternative alignments to be effected by project implementation. The resources are as follows:

- Suisun Village, known to have existed near the present location of Suisun City, likely to the southeast of Route 4.
- CA-Sol-243, an Historic Period village located near Suisun City, adjacent to Suisun Creek; this resource is known from both ethnographic and archaeological sources.
- Soneto Village, known to have existed in the vicinity of Suisun Creek, northwest of the present location of Vacaville.
- Ululato Village, known to have existed in the vicinity of Ulatis Creek, in the northwest part of Vacaville.

Prehistoric Setting

Previous archaeological work in the San Francisco Bay and Delta areas has been reviewed within a regional research context by Bickel (1976). Recent reviews of the history of Central California archaeological method and theory have been presented by Gerow with Force (1968) and Fredrickson (1973). Reference is given to these manuscripts for detail concerning the greater archaeological context of the project area.

In general, there is substantial agreement among regional archaeologists that 2000 B.C. to 2500 B.C. was probably the beginning date for the prehistoric Indian occupation of Northern California, particularly the greater San Francisco Bay and Delta area. A cultural sequence for the region, which includes the Solano County locale, was established by Lillard, Heizer and Fenenga (1939) with the estimated date of 2000 B.C. playing a major role as an archaeological marker. The three horizon cultural sequence was based on data obtained during early investigations conducted in the Stockton-Lodi Delta area by Schenk and Dawson (1929). The chronological framework established by Lillard, Heizer and Fenenga (1939) expanded on that early work, with particular emphasis on the appraisal of cultural materials from the

Windmiller Site (CA-Sac-107), the Booth Mound (CA-Sac-126) and the Augustine Mound (CA-Sac-127) (see Figure 1).

Heizer and Fenenga (1939) formulated a time chart for Central California, which reflected the culture horizons as they were understood at that time. Subsequent studies in the San Francisco Bay region (Gerow with Force, 1968) and the Northwest Coast Range locale (Fredrickson, 1973) have questioned the applicability of aspects of the culture horizon system. However, concerning the project study region the Sacramento-San Joaquin Delta Culture Horizon System continues to be the most widely accepted analytical framework for prehistoric archaeological data; the Heizer and Fenenga (1939) chart is as follows:

1800 A.D.	Late Horizon, Phase III (Historic)
1700 A.D.	Late Horizon, Phase II
500 A.D.	Late Horizon, Phase I
1500 B.C.	Middle Horizon
2500 B.C.	Early Horizon (Windmiller facies)

Regarding the specific region of the project study corridors, numerous prehistoric archaeological sites are recorded throughout the central and southern Solano County region. The existing records tend to indicate that the greatest number of known archaeological sites are concentrated around major drainage systems in protected valleys which extend toward the sloughs, marshes, rivers and bays which characterize the southern end of Solano County; archaeological sites also tend to concentrate around the sloughs and marshes and Suisun Bay where natural resources were abundant. The records also imply that the immediate environs of the numerous intermittent creeks and drainages situated throughout the study area are archaeologically sensitive.

The general project setting (and considered project alignments) are located within several of these highly sensitive environments. Based on the known record, the following areas are determined to be particularly sensitive regarding both the existence of known archaeological sites and the potential for encountering unrecorded sites:

- Green Valley - Several archaeological sites (CA-Sol-6, CA-Sol-15, CA-Sol-11, CA-Sol-70, CA-Sol-69, CA-Sol-18, CA-Sol-242, CA-Sol-239, CA-Sol-262, CA-Sol-263, CA-Sol-68 and CA-Sol-66) are situated within a 1.0 to 1.5 mile radius of alignment corridor Route No. 1. The majority of these known sites tend to concentrate along Green Valley Creek. The records indicate that one site (CA-Sol-268) is located within the actual Route 1 alignment.

- Suisun Valley - Several archaeological sites (CA-Sol-25, CA-Sol-24, CA-Sol-16, CA-Sol-71, CA-Sol-243, CA-

Sol-14, CA-Sol-244, CA-Sol-245, CA-Sol-247 and CA-Sol-254) are situated within a 1.0 to 1.5 mile radius of alignment corridor Route No. 4. The majority of these sites tend to concentrate along Suisun Creek, Ledgewood Creek and Gordon Creek and the northern extensions of Cordelia Slough.

- Lagoon Valley - Several archaeological sites (CA-Sol-57, CA-Sol-58, CA-Sol-67, CA-Sol-55, CA-Sol-59, CA-Sol-254, CA-Sol-45, CA-Sol-57, CA-Sol-52 and CA-Sol-53) are situated within a 1.5 to 2.5 mile radius of alignment corridor Route No. 1. The majority of these sites tend to concentrate along Laurel Creek and Soda Springs Creek.

- Lindsey Slough - Five known archaeological sites (CA-Sol-1 through CA-Sol-5) are situated adjacent to Lindsey Slough, approximately 1.0 mile north of alignment corridor Route No. 4. CA-Sol-1 through CA-Sol-5 are described as occupation and burial sites (Treganza and Cook, 1948) and are considered to be ethnographically, as well as archaeologically, highly sensitive.

The cultural resources sensitivity of the Green Valley, Suisun Valley, Lagoon Valley and Lindsey Slough areas has been established by academic archaeological investigations in Central Solano County (Treganza and Cook, 1948; McGonagle, 1948 and 1966; Weyand, 1980; Greengo and Arnett, n.d.) and recent EIR generated field investigations (Chavez, 1979; Holman and Chavez, 1977; Peak and Associates, 1976, 1977, 1977a, 1978; Archaeological Planning Collaborative, 1979, 1979a; McGuire, 1977) which tend to concentrate in those areas.

It is therefore possible to identify the more likely areas where archaeological resouces could be encountered during the project field study. This determination of archaeological sensitivity is made by comparing the areas in question to similar environmental settings which are known to contain archaeological resources (i.e., Green Valley Creek, Suisun Creek, Laurel Creek, Lindsey Slough, etc.) throughout central and southern Solano County. The potentially sensitive areas which are within close proximity to, or are actually transected by, the project alignments are as follows: the Suisun Slough and Denverton Slough regions; the Union Creek area; the Ulatis Creek area; the Big Ditch Creek area; the Calhoun Cut/Lindsey Slough region; and the numerous unnamed intermittent creeks which characterize much of the overall study area. The extensive plains area, which is transected by much of alignment Route No. 1 and portions of alignment Route No. 4 (and No. 6), was likely submergered by floodwaters during the winters and relatively dry during the summers in prehistoric times and, therefore, only moderately sensitive concerning potential prehistoric archaeological site occurrence.

Historic Setting

The first European to make contact with the Patwin Indian populations of Solano County was Don Juan Ayala, who landed the "San Carlos" in Suisun Bay in 1775. The full impact of that contact was apparent a short time later during the Spanish Mission era when Indian populations were forced into subjugation at the Bay Area missions and the traditional way of life rapidly disintegrated (Fredrickson, et al., 1977). Beginning in 1807 the Suisun tribel group of central Solano County began retaliating against the Spanish with raids and attacks on mission outposts, and escaping Spanish reprisals by fleeing in rafts across the Carquinez Straits and taking refuge in Suisun March (Central Solano County Cultural Heritage Commission (CSCCHC), 1977).

In 1810 Gabriel Moraga and his soldiers left the San Francisco Presidio for the purpose of counter-attacking the Suisun Indians. After fierce battles in Solano County the resistance of the native population had all but broken down and by 1810-1811 San Jose and San Francisco Mission baptismal record books show a large number of Suisuns added to the mission populations. By 1813, however, few Suisuns were added to these mission records and it appears that most had been removed from their native territory. What resistance did remain was quickly stamped out by Lieutenant José Sanchez who, in 1817, left the San Francisco Presidio with orders to subdue any rebellious elements among the Indian tribelets. By the time Father Altimira arrived in 1823, in search of a new mission site, only abandoned and collapsed dwellings remained in south-central Solano County (CSCCHC, 1977:17).

The last Spanish mission established in California was that of Mission San Francisco Solano at Sonoma in 1823. Among the Indians baptized at the mission the following year was "Sam Yeto", chief over most of the rancherias between Petaluma Creek and the Sacramento River, who was renamed Francisco Solano. Chief Solano played a major role in the dealings of North Bay Indians with the Spanish and Mexicans up until the 1830s when a smallpox epidemic (1837-1839) decisively eliminated the Patwins (as well as Indians throughout north-central California), as a force to be dealt with (Peterson, 1957; CSCCHC, 1977).

In 1821 California became independent from Spain and the missions were divested of their lands. As was the practice under the Mexican government, large landgrants were established and in central Solano County the ranchos which covered lands in the study area were Rancho Suisun, Rancho Tolenas, Rancho Los Putos and Rancho Soscol. The ranchos were almost exclusively devoted to the raising of cattle, with vineyards and fruits and vegetables being planted for the ranchers own needs (Hoover, Rensch and Rensch, 1966: 511).

With the annexation of California by the United States government in July 1846, and the subsequent discovery of gold in the Sacramento Valley on January 24, 1848, thousands of people poured into California; the increase in polulation was the stimulus that caused central Solano County to turn to agriculture. Ranchers and farmers discovered that profits could be made by selling their surplus crops to miners and the raising of livestock began to assume a secondary land use position. With the Irish famine and poor wheat harvests in Europe, the cultivation of wheat in Solano County expanded as prices continued to rise in the foreign markets (CSCCHS, 1977:21-22).

In 1850, at the site of a pre-Spanish encampment and burial ground of the Suisun Indian people, J. M. Perry established a blacksmith shop in the area that was to become known as Rockville. Founded on the stage road between Benicia and Sacramento, in a highly agricultural area, Rockville slowly grew throughout the 1850s; it eventually attracted a cluster of local service institutions such as an hotel, shops, a school, a stage depot, a post office and a church (Hoover, Rensch and Rensch, 1966:520; CSCCHC, 1977:24).

Recognizing the importance of water transporation in the Suisun Valley, Robert Waterman, owner of Suisun Rancho (which encompassed most of the valley) decided to develop a shipping point on his ranch, south of Rockville. Several navigable waterways (Cordelia Slough, Suisun Creek, Suisun Slough), could be found on Waterman's property and he choose a site at the head of Cordelia Slough for the location of his settlement (CSCCHC, 1977:24-25).

Cordelia (named after Waterman's wife and the second oldest city in Solano County) became quite well known as a shipping center, as well as a stopping place for stages and travelers. A post office was established there in 1854, however it moved north to Rockville in 1858. In 1869 the post office was reestablished in Cordelia and operated there until 1943. By 1868 stone from a nearby quarry was being shipped down the Cordelia Slough, from Bridgeport Landing, and across the Bay to San Francisco, where it was used in the paving of streets and the construction of buildings. By this same year the California Pacific Railroad (Southern Pacific) was running through Cordelia via Bridgeport (Hoover, Rensch and Rensch, 1966:519).

The area that was to become Suisun City was first visited via Suisun Slough in 1850 by Dr. John Baker and Curtis Wilson, and later that year by Captain Josiah Wing. Finding an island in the slough, Wing hoped to establish a landing from which to ship the farm products of central Solano County and to this end he constructed a warehouse and wharf on the island in 1852. With the success of the area as a shipping point, the population grew and by 1854 the city of

Suisun was laid out west of the landing. In 1868 the railroad came to Suisun and the city was incorporated (CSCCHC, 1977:25).

With the success of Suisun City, Cordelia soon lost its importance as a shipping point. As a result, Waterman established a new town in 1856 and named it Fairfield. In order to assure that his new town would prosper, Waterman took advantage of the heated debates raging in Solano over a new location of the county seat. Waterman not only offered to donate sixteen acres of land to Fairfield for this purpose but also an additional four blocks and money to place county buildings on the land. On September 2, 1858, the people of Solano voted to have Fairfield replace Benicia as the local seat of government. Although the city became the county seat, because of its poor position in relation to water (and later rail) transporation, Fairfield never realized success as a trading center and was not incorporated until 1903 (CSCCHC, 1977:25-26; Hoover, Rensch and Rensch, 1966:523).

By 1860 most of the civilian towns in central Solano County had been founded and during that decade farmers and ranchers prospered. Ditches were replaced by wooden fences, log cabins abandoned for houses constructed of lumber and solid buildings of local stone were build by large land owners (Hoover Rensch and Rensch, 1966:520).

The coming of the railroad in 1868 caused some economic changes in central Solano County. Shipping of farm products by rail rather then water reduced trading in Suisun. The decline in European wheat imports as well as the extension of tracks into the San Joaquin and Sacramento Valleys (and thus their access to the foreign markets), helped cause a decline in wheat prices. As a result, by the late 1870s orchards began to replace the wheat fields (CSCCHC, 1977:28).

In the late 1860s and 1870s, it appeared that wine and table grapes might succeed wheat cultivation; however by the 1880s the fruit orchards had become the agricultural foundation in central Solano County. Many canneries and packing houses were erected adjacent to the railroad tracks in Suisun and they became important local industries by the turn of the century. During that period a diverse population, including Chinese, Japanese, Portugese, Greeks, Italians, Filipinos, and Hindustanis, could be found laboring in the orchards and in the claiming of thousands of Suisun marshland acres for agricultural use (CSSCHC, 1977:29-32).

Although agriculture was the base of the local economy, beginning in the 1870s, the quarrying of local stone and mineral deposits became a major economic activity. Three quarries near Cordelia gave that area a welcome economic boost; however the most extensive quarrying, of onyx and travertine, took place around Cement Hill, located northeast

of Fairfield. Quarrying operations at Cement Hill were suspended prior to 1900 and then resumed in 1902 when Pacific Portland Cement Company established a tufa quarry and cement factory at the base of the hill. By 1907 it was one of the largest cement plants in the western United States, however with the onset of the Depression by 1927 the Cement Hill plant and adjacent town of Cement were abandoned (CSCCHC, 1977:33-34).

The Depression also had an adverse effect on agriculture as farm incomes decreased by 50% between 1929 and 1932; canning and packing companies began closing and fresh fruit shipments to the east virtually stopped. Although fresh fruit shipments eventually resumed and continue today, increasing proportions of the local crops are dried or canned at companies in Sacramento or in the Bay Area (CSSCHC, 1977:40-42).

Up until the turn of the century the population of Suisun City had always been greater than that of Fairfield; however, as dry land became scarce in Suisun, Fairfield's open lots became popular for homesites and by 1910 the population was slightly larger in the northern community. The first state highway through Solano County was built between 1912 and 1914; during the mid-1960s the reconstruction of U.S. Highway 80 as an eight-lane freeway, further caused Fairfield's population to increase. With the establishment of the Fairfield-Suisun Army Airfield in 1942, and its subsequent take-over in 1949 by the U.S. Air Force, many military and non-military employees moved permanently into the area and today Fairfield is by far the largest community in central Solano County (CSSCHC, 1977:34).

Despite the transformation of central Solano County into an essentially urban area, much of its historic landscape remains. Numerous structures and features important to the history of Solano County are evident throughout the general project setting; despite the historic sensitivity of the region, review of the records (including national, state and local historic registers and listings) suggests that no recorded historic resources fall within any of the three project study corridors. It is however noted that several historically significant structures are situated relatively close to the project alignments, and they are identified as follows:

- Route 1

    - The Ramsey-Nightingale House (ca. 1860), which is located on Green Valley Road, approximately 0.3 miles north of the alignment corridor.

    - An unnamed Historic Ranch Cluster (ca. 1900) located on Green Valley Road, approximately 0.2 mile south of the alignment corridor.

- The Suisun Valley Fruit Growers Association Building (originally Pacific Fruit Exchange - ca. 1920) located adjacent to U.S. Highway 80, approximately 150 feet north of the alignment corridor.

- The Eaton Ranch Complex (ca. 1920, house; ca. 1890, barn) located adjacent to U.S. Highway 80, approximately 200 feet north of the alignment corridor.

- The Clyde's Lawn-Leisure Building (originally Stewart Fruit Packing Company - ca. 1920) located adjacent to U.S. Highway 80, approximately 150 feet north of the alignment corridor.

- The Boynton House (ca. 1855) located in the 800 block of Beck Avenue, approximately 100 feet south of the alignment corridor.

- The Cement Hill Historic District (ca. 1905-1920) located northeast of Fairfield, approximately 0.2 to 0.4 mile north of the alignment corridor.

- Route 4 (and Route 6)

  - The Nelson Hill Quarries (ca. 1870) located above Cordelia Road, approximately 400 feet west of the alignment corridor.

  - Historic House located at 340 Cordelia Road (ca. 1860), which is approximately 125 feet east of the alignment corridor.

  - The PG&E Cordelia Substation (ca. 1915) located on Cordelia Road, approximately 0.15 mile southwest of the alignment corridor.

  - The Switchman's Cottage (ca. 1905) located at 339 Thomasson Lane at Southern Pacific Railroad tracks, approximately 120 feet from the alignment corridor.

  - The Agricultural Cluster (ca. 1915-1940) buildings and two silos located on Thomasson Lane, approximately 300 feet south of the alignment corridor.

  - The Southern Pacific Railroad Tunnel (n.d.) located near Thomasson Lane, approximately 0.2 mile west of the alignment corridor.

  - The McCreary/Thomasini Ranch House (ca. 1870) located on Cordelia Road, approximately 100 feet south of the alignment corridor.

  - The Suisun-Fairfield Railroad Station (ca. 1910) located at Main Street and Union Avenue, approximately 150 feet south of the alignment corridor.

- **The Historic Ranch Cluster (ca. 1890) located at 35 Sandia, approximately 0.1 mile north of the alignment corridor.**

FIELD INVESTIGATIONS

The Archaeological Field Reconnaissance of the three North Bay Aqueduct Alignment Alternatives was conducted by consultant David Chavez, with assistance from the following experienced archaeologists: Jan Hupman (B.A., San Francisco State University; William Mulloy (B.A., Sonoma State University; and Lowell Damon (B.A., Sonoma State University). The survey work was accomplished during late July/early August 1980.

The field investigation of the alignments can be described as a General Surface Reconnaissance (King, Moratto and Leonard, 1973). During the survey, close attention was given to the detection of those surface features which suggest the presence of prehistoric cultural resources in this part of Solano County (changes in soil color, composition and/or texture which suggest the occurrence of archaeological midden; unusual ground contours or abrupt changes in vegetation patterns; and the presence of prehistoric artifacts, obsidian, basalt, chert and/or other types of lithic flaking wastes, fire-fractured rock, charcoal deposits and/or charred faunal remains). Also, all rock outcroppings were examined for the presence of rock quarries, petroglyphs and bedrock mortars. Further, during the field inspection, attention was given to the potential presence of historic resources remains and features.

The following reconnaissance discussions are presented for each of the alignment alternatives:

- Route 1 - The survey of this potential project alignment was accomplished by walking the entire 30 mile corridor. Two person survey teams were assigned specific linear segments of the corridor and the two individuals spaced themselves at appropriate distances from each other so as to accomplished maximum coverage of the 80-90 foot wide corridor; also, a zig-zag crossover pattern was utilized by the survey teams to assure comprehensive archaeological inspection of the study area. The following observations were made during the field investigations of the Route 1 Alignment:

    - Section from Cache Slough to Vacaville Junction (Maps 1, 2 and 3) - Some agriculture fields were present between Cache Slough and State Highway 113 (Map 1) and inspection consisted of walking the perimeters of the fields and spot checking the actual alignment as accessibility allowed. Some agricultural fields were also present approximately 1.8 to 2.5 miles east of where the alignment crosses Union Creek (Map 2); inspection of those fields was accomplished in a similar manner. The remainder of the corridor section consisted of

open grassland terrain, with some dirt roadway available for inspection east of State Highway 113. Dense grass was encountered in some portions of the corridor, however fair to moderately good inspection of the ground surface generally prevailed. Survey efforts in this section of the corridor particularly emphasized the examination of the terrain where the alignment approaches Cache Slough, and where it transects Union Creek and other unnamed intermittent creeks.

No evidence of the occurrence of cultural resources was encountered in this section of the Route 1 Alignment Corridor.

- Section from Vacaville Junction to Interstate 80 (Maps 3 and 4) - This segment of the survey corridor followed an abandoned railroad alignment. With the exception of the first 1.2 miles west of Vacaville Junction (where the grass and weed coverage was relatively dense), this section of the Route 1 Alignment was well inspected. Particular survey efforts were concentrated in the vicinity of the Laurel Creek crossing (Map 3).

  No evidence of the occurrence of cultural resources was encountered in this section of the Route 1 Alignment Corridor. It was observed that one known historically significant structure (the Boynton House) is situated within 75 to 100 feet of the south boundary of the project corridor (Map 4); it was however determined that the house is at sufficient distance from the alignment corridor so that no adverse impacts should result from project implementation. It is recommended, however, that special attention be given to this resource by strictly confining the construction activities to the delineated alignment corridor.

  It was further observed that the Cement Hill historic resources are located at sufficient distances from this section of the Route 1 Alignment Corridor so as not to be adversely effected by project implementation.

- Section adjacent to Interstate 80 (Map 4) - This segment of the survey corridor, which runs adjacent to the north side of Interstate 80, was subjected to a relatively comprehensive survey. The terrain consisted of farm roads, orchards and open fields and the ground surface was well exposed for archaeological inspection. Particular care was taken to completely survey the terrain where the alignment crosses Ledgewood Creek and both branches of Suisun Creek.

No evidence of the occurrence of cultural resources was encountered in this section of the Route 1 Alignment Corridor. It was further observed that the recorded historic resources located adjacent to this section of the Route 1 Alignment (the Clyde's Lawn-Leisure Building, the Eaton Ranch Complex and the Suisun Valley Fruit Growers Association Building), are all at sufficient distances from the actual construction disturbance corridor so as not to be effected by project implementation.

- Section from Interstate 80 to the existing Cordelia Surge Tank (Map 5) - This portion of the survey corridor was characterized by the presence of open fields, orchards and some vineyards. Overall, survey conditions throughout this alignment section were good as vegetation was not dense, and a relatively comprehensive field inspection was accomplished. Survey efforts were particularly thorough throughout this section, as the record suggests a high level of archaeological sensitivity in the entire Green Valley area. Intensive survey efforts were concentrated at the Green Valley Creek crossings.

  Evidence of one previously recorded archaeological site (CA-Sol-268) was found to be located within the corridor boundaries of this section of the Route 1 Alignment (Map 5). Also, an historic resource in the form of a stone fence was found to transect the Route 1 Alignment (Map 5). These cultural resources are discussed in greater detail in the following section of this report.

  Field survey efforts in this section of the Route 1 Alignment resulted in the determination that neither of the previously discussed historic resources (Unnamed Historic Ranch Cluster on Green Valley Road and the Ramsey-Nightingale House also located on Green Valley Road), will be effected by project implementation; those recorded resources are at sufficient distances from the project disturbance zone so as not to be adversely impacted.

The following observations were made at the Route 1 facilities locations:

- The 1.0 acre Pump Station location at the Cache Slough Intake (Map 1) was closely examined; no evidence of cultural resources was encountered at that area.

- The 0.15 acre Surge Tower location (Map 2) was thoroughly surveyed and no evidence of cultural resources was detected at that site.

- The 15 acre Reservoir location in Green Valley (Map 5) was thoroughly inspected. Close attention was given to this potential facility site, as that region of Green Valley is highly sensitive regarding the occurrence of archaeological resources; archaeological sites CA-Sol-15, CA-Sol-70 and CA-Sol-69 are all located within 0.2 to 0.4 mile from the proposed reservoir area. However, no evidence of archaeological deposits was encountered at the 15 acre location; further, it was observed that none of the closeby resources will be adversely effected by the reservoir development.

- Route 4 - The field reconnaissance of this 28 mile potential project alignment was accomplished in the same manner as described for the Route 1 Alignment. The following observations were made during the field inspection of this study corridor:

  - Section from Lindsey Slough to Suisun City (Maps 6, 7, 9 and 10) - The eastern portion of this segment of the Route 4 Alignment follows dirt roadways from Lindsley Slough to Travis Air Force Base property and cuts across open fields and eventually aligns itself with State Highway 12 just west of Travis AFB; from Travis AFB to Suisun City the alignment runs south of and adjacent to State Highway 12. Those portions of this segment of the alignment which run along or adjacent to established roadways were subject to a thorough survey, as the ground surface was well exposed despite the presence of grass and some agricultural fields. The portions of this route which cut across open fields (south of Travis AFB - Map 9), were subject to an adequate survey, although some ground surface areas were partially obscured by relatively dense grass cover.

    It is noted that this section of the Route 4 Alignment runs along State Highway 12 and the other established roadways; whereas this section of the Route 6 Alignment runs on the south side of those roadways. Therefore survey efforts were designed to cover both sides of the roadway, with a greater portion of the 80-90 foot corridor extending on the south side of those roadways.

    Survey efforts were particularly intensified in the vicinity of Lindsey Slough, the Big Ditch crossing (Map 6), the Denverton Creek crossing (Map 7), the Union Creek and Laurel Creek crossings (Map 9), and the locations where the alignment crosses the numerous unnamed intermittent creeks which feed into the various sloughs to the south.

No evidence of archaeological resources was encountered within this section of the Route 4 Alignment. It was observed that the project corridor does pass relatively close to two historic resources (the Peterson Ranch - Map 6 and the Scandia Road Ranch - Map 9); however, it was determined that the historically significant structures associated with those ranches are all located at sufficient distances from the alignment corridor boundary so as not to be adversely effected by project implementation.

- Section from Suisun City to Interstate 80 (Maps 10 and 4) - This segment of the Route 4 Alignment mostly transverses open fields from Suisun City to Thomasson; the terrain consisted of grass and weed covered open fields, which were subject to a relatively comprehensive archaeological survey. The exception was a small portion of the alignment which crosses a turf farm; the ground surface was mostly obscured in that area, however that location was surveyed by spot checking along the dirt roads which crossed the nursery area. The alignment from Thomasson to Interstate 80 followed an existing dirt road and survey conditions in that region were relatively good.

  Survey efforts were particularly intensified in the vicinity of the Ledgewood Creek and Suisun Creek crossings (Map 10). No evidence of prehistoric archaeological resources was encountered in this section of the Route 4 Alignment. However, one previously undocumented historic archaeological resource was discovered within the alignment corridor (Map 10). Details concerning this resource are presented in the following report section.

  It was observed that the numerous previously recorded historic resources (the Suisun-Fairfield Railroad (SPRR) Station; the McCreary-Thomasini Ranch House on Cordelia Road; the Southern Pacific Railroad Tunnel near Thomasson; the Historic Buildings and Silos Cluster on Thomasson Lane; the SPRR Switchman's Cottage on Thomasson Lane; the PG&E Cordelia Substation on Cordelia Road; the Historic House at 340 Cordelia Road; and the Nelson Hill Quarries above Cordelia Road) which are found throughout this alignment section area, are all located at sufficient distances from the Route 4 Alignment Corridor so that no adverse impacts will occur due to project implementation.

- Section from Interstate 80 to the existing Cordelia Surge Tank (Map 5) - This segment of the

Route 4 Alignment is the same for the Route 1 Alignment and reference is given to that discussion.

The following observations were made at the Route 4 facilities locations:

- The 1.0 acre Pump Station location at the Lindsey Slough Intake (Map 6) was thoroughly examined; no evidence of cultural resources was encountered at that facility area.

- The 0.15 acre Surge Tower location (Map 6) was thoroughly surveyed and no evidence of cultural resources was present at that area.

- The 1.0 acre Pump Station location adjacent to Union Creek (Map 9) was thoroughly inspected and no evidence of cultural resources was encountered at that location.

- The 15 acre reservoir location (Map 5) was surveyed, as previously discussed under Route 1 consideration.

- Route 6 - With the exception of the approximately two mile variation (Map 7), the survey corridor for this route was the same as for the Route 4 alignment, and reference is given to that discussion. The two mile variation cuts across open fields which were characterized by the presence of grass. A relatively adequate survey was accomplished of that corridor section, and no evidence of cultural resources was encountered.

It is noted that, generally speaking, the North Bay Aqueduct Alignment Alternatives were readily identifiable in the field. Those alignment sections which followed roadways and railroad corridors were easily recognized. In areas where the alignments crossed open terrain, natural and man-made features which are identified on the maps and were visible in the field, were utilized to define the alignment corridors. In the few situations where no such features were present, or were unreliable, alignments were established by taking precise instrument readings from the maps and utilizing Brunton compasses in the field. Overall, it is believed that a comprehensive field reconnaissance of the three alignments was accomplished.

IDENTIFIED RESOURCES

The following cultural resources were found to be located within the alternative alignment corridors. It is noted that Standard Site Survey Records have been completed for these resources and are enclosed in Appendix C; copies of the records will be filed with the California Archaeological Site Survey Regional Office at Sacramento State University.

- Routes 1, 4 and 6

    - CA-Sol-268 is a prehistoric archaeological site which is located within the alignment corridor section between Interstate Highway 80 and the Cordelia Surge Tank (Map 5). The site was originally recorded in 1977 by Eric McGuire and described as a partially destroyed, shallow midden-deposit; surface evidence of archaeological deposits consisted of medium brown friable soil with obsidian flakes and shell fragments present. The site dimensions were estimated to be 10 meters x 20 meters.

      Inspection of the site location during the subject investigations resulted in the detection of further obsidian flakes and some shell; however the actual parameters of the site were not obvious from surface investigations. It was observed that the site was badly damaged as a result of road grading at the northern end of the reported site location.

      A preliminary significance evaluation of the site, based on the National Register of Historic Places nomination criteria (30 CFR 60.6) resulted in the determination that CA-Sol-268 would not be eligible for inclusion on the National Register. Based on previous (McGuire, 1977) and current field observations, the site would appear to be relatively small and badly damaged. However, the site potentially is of regional significance regarding the understanding of prehistoric cultural activities.

    - The Rock Fence Segments are historic features which are located within the alignment corridor section between Interstate Highway 80 and the Cordelia Surge Tank (Map 5). The segment of the rock fence which transects the alignment corridor likely dates from the late 1800s when numerous such fences were constructed to mark boundary lines and serve as stock fences. The rock structures are representative of a time in Solano (Napa and Sonoma) County history when the Spanish land-grant allotments were being sold to private owners

(Fredrickson, 1977). As such, the fences are of regional significance; however, a preliminary significance evaluation of the resources based on the National Register of Historic Places Nomination Criteria (30 CFR 60.6), results in the determination that the rock fence segments would not be eligible for inclusion on the National Register.

- Routes 4 and 6

  - The Historic Archaeological Site is located within the alignment corridor section between Suisun City and Interstate 80 (Map 10). The site consists of a stone foundation and extensive soil buildup, which suggests the ruins of a possible homestead or ranch house location. No historic artifacts were encountered on the ground surface; however, diagnostic items are likely located on the site and/or below the ground surface. Further exploration of the resource is required before definitive statements can be made regarding the significance of this historical archaeological site; however, a preliminary significance determination based on National Register Nomination Criteria (30 CFR 60.6), results in the tentative determination that this resource would not be eligible for inclusion on the National Register.

DISCUSSIONS OF IMPACTS AND MITIGATION

The following impact and mitigation discussions are presented with the realization that the alternative North Bay Aqueduct Alignments are not yet precisely defined within the 80 to 90 foot wide study corridors; therefore potential impacts may increase or decrease based on alignment variation within the corridors. In order to establish an effective Cultural Resources Management Program for this project, the maximum potential impacts will be assumed and alternative mitigation measures presented accordingly.

- CA-Sol-268 - The vertical and horizontal nature of this site has yet to be established with any certainly; despite the fact that portions of the site have been destroyed, no assumptions should be made concerning the potential for subsurface, intact archaeological deposits which could be disturbed during construction. If such deposits are present, potential impacts could result from any of the various construction activities associated with a project of this nature. Brush clearing, the moving of construction vehicles, stacking of pipe sections, storage of equipment and, of course, actual pipeline trenching are all activities which could result in direct and severly adverse impacts to archaeological resources.

  The following mitigation alternatives which would adequately off-set the potential adverse impacts to the archaeological site CA-Sol-268 are therefore presented:

  1. Design the aqueduct alignment for that portion of Routes 1, 4 and 6 (Map 5) so that the aqueduct pipeline would avoid the location of the archaeological site. This could be accomplished by establishing the actual pipeline alignment approximately 100 feet to the south of the site location; realignment to the north is not recommended because of the presence of segments of the Historic Stone Fence (Map 5). Based on the surface evidence reported by McGuire (1977) and our recent field inspection, it is determined that the horizontal extension of subsurface deposits likely would not approach 50 feet beyond the known location of the site; therefore, the recommended alignment alteration distance would be adequate to avoid any potential subsurface deposits.

  2. The above mitigation alternative would be the most effective approach to cultural resources preservation in response to the proposed project. Should such site avoidance prove to be impossible, then data recovery through site excavation would be recommended. If such a mitigation measure becomes necessary, a two phase subsurface investigation

would be recommended. The first phase should involve a limited testing program of subsurface units and hand augerings; the objective of this phase would be to determine if subsurface archaeological deposits are present, and if so, the horizontal and vertical extent of the deposits. Based on the phase one findings, a data recovery program through excavation could then be developed, as approriate.

It is further recommended that if such archaeological excavations become necessary, the work be accomplished by a professional archaeologist familar with the prehistory of the Solano County area. Also, such excavations should be accomplished with the full participation and approval of local California Indian organizations.

- Stone Fence Segments - The stone fence segment, which transects this section of the aqueduct alignment (common to all three Routes 1, 4 and 6), could potentially be subject to adverse impacts as a result of pipeline installation at that location. The following mitigation alternatives are recommended for minimizing the adverse effects which could result from the project:

1. The aqueduct alignment could be designed so as to pass through the existing break in the fence, by which an existing dirt road now passes. This measure would be the most effective means of maximizing the protection and preservation of this historic resource.

2. If the above measure cannot be accomplished, then it is recommended that the possibility of trenching under the fence without disturbing or damaging the rock feature be explored.

3. If disturbance of the rock fence cannot be avoided, then it is recommended that the least amount of the feature be disturbed by project construction activities. This can be accomplished by removing by hand those portions of the fence necessary for project implementation. It is noted that the majority of this historic feature would remain intact, and removal of a small section would not diminish the overall historic or aesthetic significance of the fence. Further, it is likely that with the assistance of an experienced historic structures professional, the removed section can be replaced after construction is completed.

It is further recommended that no matter which of these mitigation alternatives are implemented, efforts be made to minimize other than absolutely necessary

construction activities in the vicinity of the stone fence segments in this alignment(s) section.

- Historic Archaeological Site - The discernable horizontal extent of this cultural resource is located well within the project corridor associated with the Route 4 and 6 alignments. Impacts to this historic archaeological site could result from the various construction activities associated with a project of this nature. Brush clearing, the moving of construction vehicles, stacking of pipe sections, storage of equipment and, of course, actual pipeline trenching are all activities which could result in direct and severly adverse impacts to archaeological resources.

The following alternatives which would adequately mitigate the potential adverse impacts to the subject historic archaeological site are therefore recommended:

1. The aqueduct alignment for that portion of Routes 4 and 6 (Map 10) could be designed so as to avoid the location of the historic resource. This could be accomplished by establishing the actual pipeline alignment approximately 100 feet to the north or south of the resource location. Based on surface evidence evaluations, it is determined that the recommended alignment alteration would place the construction activities at an adequate distance from the subject cultural resource.

2. The above mitigation alternative would be the most effective means of preserving the historic archaeological site. Should such site avoidance prove to be impossible, then data recovery through site excavation would be the recommended mitigation measure. If such a program becomes necessary, a two phase subsurface investigation is recommended. The first phase should involve a limited testing program of subsurface units and hand augerings; the purpose of this phase would be to determine the exact horizontal and vertical extent of the site and its cultural content. Based on the phase one findings, a data recovery program through archaeological excavation could then be developed, as appropriate.

CONCLUSIONS

The results of the archival review and field investigations lead to the conclusion that despite the relatively high cultural resources sensitivity of the general project setting (and despite the occurrence of three cultural resources within the North Bay Aqueduct Alternative Alignments), cultural resources considerations should not constitute insurmountable constraints on project implementation.

Based on the study findings, it is determined that the Route 1 Alignment would be the preferred aqueduct route. This conclusion is based on the fact that utilization of the alignment would potentially result in impacts to only two known cultural resources; whereas, utilization of the Route 4 or Route 6 Alignment would potentially result in impacts to three known cultural resources.

The known cultural resources which are situated within the project alignment corridors have been identified, and discussions concerning potential impacts to those resources have been presented. These evaluations, however, do not preclude the possibility that archaeological remains exist below the ground surface and could be encountered during land alteration activities associated with the proposed project. In the event that archaeological remains are encountered during subsurface construction activities, land alteration work in the general vicinity of the find should be halted and a qualified archaeologist should be consulted. Prompt evaluations could then be made regarding the finds, local Native American organizations consulted, and a course of action acceptable to all concerned parties could then be adopted.

REFERENCES

Archaeological Planning Collaborative

1979 Archaeological Records Search and Reconnaissance Survey: Fairfield Redevelopment Project, Fairfield, California. Report on File at the California Archaeological Site Survey Regional Office, Sacramento State University. Sacramento.

1979a Archaeological Records Search and Reconnaissance Survey: Cement Hill Road Sewer and Water Project. Report on File at the California Archaeological Site Survey Regional Office, Sacramento State University. Sacramento.

Bennyhoff, James A.

1950 Patwin and Coast Miwok Ethnogeography. Manuscript Available through Department of Anthropology, University of California. Berkeley.

1977 Ethnogeography of the Plains Miwok. Center for Archaeological Research at Davis. No. 5. Davis.

Bickel, Polly

1976 Toward a Prehistory of the San Francisco Bay Area. Unpublished Ph.D. Dissertation. Department of Anthropology, Harvard University. Cambridge.

California Inventory of Historic Landmarks

1979 Published by the Resources Agency, Department of Parks and Recreation. State of California. Sacramento.

California Inventory of Historic Resources

1976 Published by the Resources Agency, Department of Parks and Recreation. State of California. Sacramento.

Central Solano County Cultural Heritage Commission

1977 Our Lasting Heritage: An Historic and Archaeological Preservation Plan for Central Solano County. Publication Available from the Solano County Planning Department. Fairfield.

Chavez, David

1979 Preliminary Cultural Resources Assessment of the Cement Hill Location, Solano County, California. Report on File at the California Archaeological Site Survey Regional Office, Sacramento State University. Sacramento.

Cook, S. F.

1943 The Conflict Between the California Indian and White Civilization, Part I. Ibero-Americana. Vol. 21:180. Berkeley.

Corps of Engineers
1979 Public Notice No. 12950-58. Dated December 3, 1979.

Davis, James T.
1974 Trade Routes and Economic Exchange Among the Indians of California. Ballena Press Publication in Archaeology, Ethnology and History, No. 3. Ramona.

Fredrickson, David A.
1973 Early Cultures of the North Coast Ranges, California. Ph.D. Dissertation. Department of Anthropology, University of California. Davis.

1977 Historical and Archaeological Resources. Vol. III, Chapter VIII. "Socioeconomic Conditions" in a Summary of Knowledge of the Central and Northern California Coastal Zone and Offshore Areas. Manuscript on File at the Anthropological Studies Center, Sonoma State University. Rohnert Park.

Gerow, Bert with Roland W. Force
1968 An Analysis of the University Village Complex: With a Reappraisal of Central California Prehistory. Stanford University Press. Stanford.

Greengo, R. E. and A. A. Arnett
n.d. Analysis of Artifacts from Peterson 2 (4-Sol-2). University of California Archaeological Survey Manuscripts, No. 105. Berkeley.

Heizer, Robert F. and F. Fenenga
1939 Archaeological Horizons in Central California. American Anthropologist, Vol. 41:378-399. Washington, D.C.

Holman, Miley and David Chavez
1977 Archaeological Monitoring of Southwood Estates Development Area (Unit No. 2), City of Vacaville, Solano County, California. Report on File with the City of Vacaville Planning Department.

Hoover, M. B., H. E. Rensch and E. G. Rensch
1966 "Solano County" In Historic Spots in California. Stanford University Press. Stanford.

Johnson, Patti J.
1978 "Patwin" In Handbook of North American Indians, Vol. 8:350-360. Robert F. Heizer, (Editor). Smithsonian Institution. Washington, D.C.

King, T. F., M. J. Moratto, and N. N. Leonard III
1973 Recommended Procedures For Archaeological Impact Evaluation. Published Jointly by the Society of California Archaeology and the University of California. Los Angeles.

Kroeber, Alfred L.
1925 Handbook of the Indians of California. Bureau of American Ethnology Bulletin 78. Smithsonian Institution. Washington, D.C.

1932 The Patwin and Their Neighbors. University of California Publications in American Archaeology and Ethnology, Vol. 29, No. 4. Berkeley.

Lillard, J. B., R. F. Heizer and F. Fenenga
1939 An Introduction to Central California Archaeology. Sacramento Jr. College Department of Anthropology Bulletin, No. 2. Sacramento.

McGonagle, Robert L.
1948 A Report on the Excavation of Peterson No. 1, Solano County. University of California Archaeological Survey Manuscripts, No. 8. Berkeley.

1966 The Cooke Site: A Middle Horizon Site in Central California. Unpublished M.A. Thesis. University of California. Davis.

McGuire, Eric
1977 Archaeological Survey for the Mangles Ranch Development Plan, Cordelia, California. Report on File at the California Archaeological Site Survey Regional Office, Sacramento State University. Sacramento.

McKern, W. C.
1923 Patwin Houses. University of California Publications in American Archaeology and Ethnology, Vol. 20(10): 159-171. Berkeley.

National Register of Historic Places
1979 Federal Register, 44:26; Department of Interior, National Park Service (February 6, 1979).

Peak and Associates, Inc.
1976 Cultural Resources Assessment of the Road Expansion and Installation of a 24" Water Transmission Main Along Cement Hill Road from Dover Avenue East to New Travis A.F.B. Hospital. Report on File at the California Archaeological Site Survey Regional Office, Sacramento State University. Sacramento.

1977 Cultural Resources Assessment of the William H. M. Smith Property, Cordelia, California. Report on File at the California Archaeological Site Survey Regional Office, Sacramento State University. Sacramento.

1977a Cultural Resources Assessment of the Citation Homes Development, Green Valley, California. Report on File at the California Archaeological Site Survey Regional Office, Sacramento State University. Sacramento.

Peak and Associates, Inc. (continued)
1978 Cultural Resources Assessment of the Neitzel Hill Property, Solano County, California. Report on File at the California Archaeological Site Survey Regional Office, Sacramento State University. Sacramento.

Peterson, Marcus
1957 The Career of Solano, Chief of the Suisun. Unpublished M.A. Thesis. University of California. Berkeley.

Schenk, W. E. and E. G. Dawson
1929 Archaeology of the Northern San Joaquin Valley. University of California Publications in American Archaeology and Ethnology, Vol. 25:289-413. Berkeley.

Treganza, A. E. and S. F. Cook
1948 The Quantitative Investigation of Aboriginal Sites: Complete Excavation with Physical and Archaeological Analysis of a Single Mound. American Antiquity, Vol. 13, No. 4:287-297.

Weyand, Helen S.
1980 Personal Communication. (Discussions concerning early archaeological investigations in Solano County.)

Whistler, Ken
1976 Classification of Wintun Languages. (Paper read at the Annual Meeting of the American Anthropological Association, Washington, D.C., 1976.)

APPENDIX F

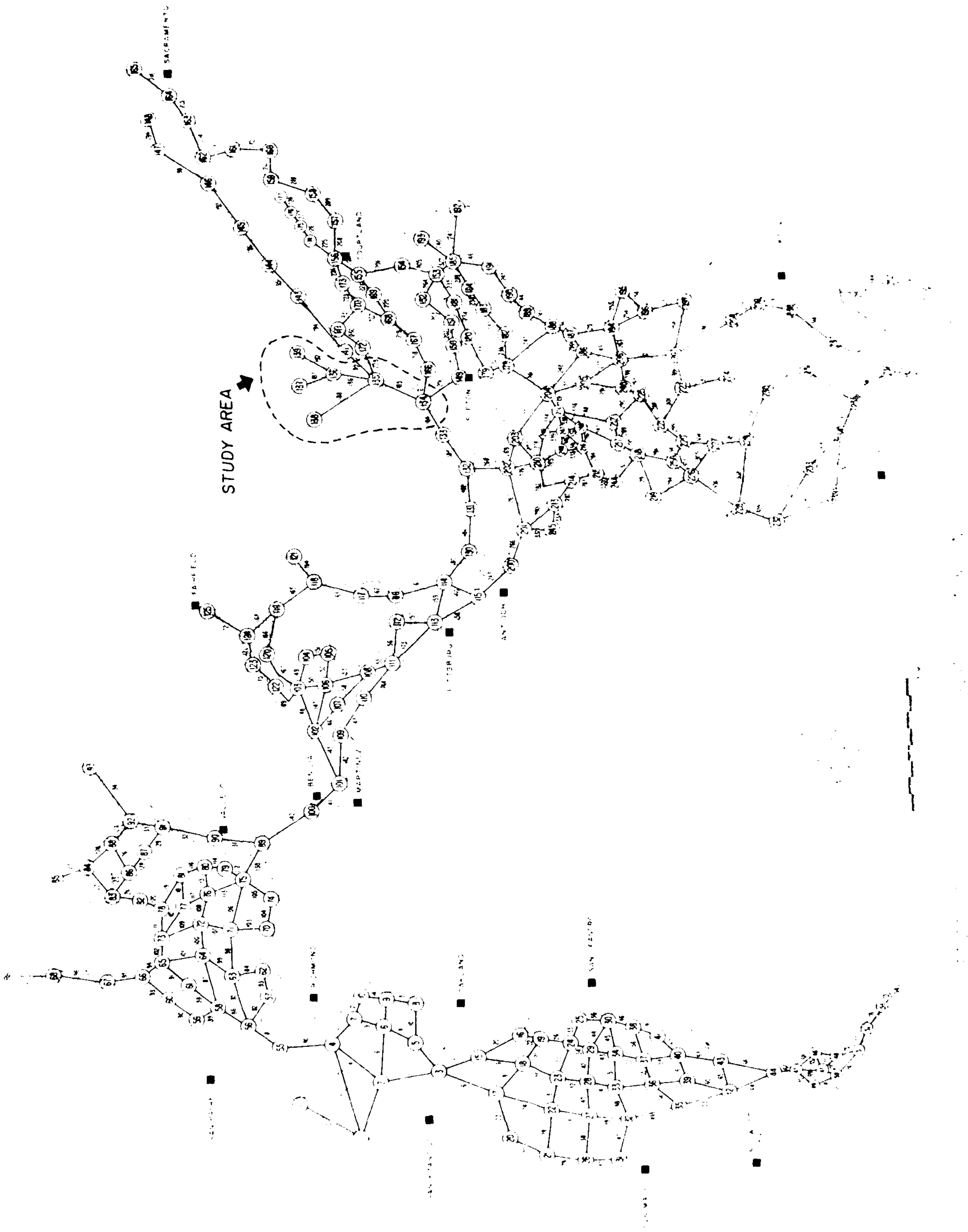
COMPUTER ANALYSIS OF WATER QUALITY AND HYDRAULIC IMPACTS

The impact of the North Bay Aqueduct on Delta water quality and hydraulics has been analyzed with the aid of two computer based numerical models. These models have evolved over the past 15 years for direct application to the San Francisco Bay Delta system. The models have been specifically designed to aid in the evaluation of various alternative water and wastewater management plans.

The *Tidal Hydraulics Model* has been applied to a network of 253 nodes interconnected by 345 links (Figure 1). The primary purpose of a mathematical tidal hydraulics model is to provide quantitative temporal descriptions of tidal flows, current velocities, water levels, and tidal volumes. These must be provided for representative hydrographic conditions and for the specific water resource management alternatives being considered. Secondary requirements of the model may be to supply information on specific parameters that may be needed in companion models to estimate mixing coefficients, mass transfer rates, or other empirical coefficients.

The *Tidally Averaged Water Quality Model* was developed to predict either steady state or time varying, tidally averaged values of dissolved oxygen, biochemical oxygen demand, any conservative constituent, and any nonconservative constituent that behaves according to first-order kinetics. The primary parameter that is adjusted is the "effective mixing coefficients" that represent the combined effects of vertical and transverse velocity variations, intertidal flows, constantly changing tides, density inducted mixing, and all other factors not represented by tidally averaged flows. Additional details and descriptions of the models are available in WRE (1974).

The most recent calibration and verification of the models was performed in 1977 when the models were used in conjunction with the Delta Water Rights Hearing conducted by the California State Water Resources


STUDY AREA
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Control Board. The background and results of the model calibration and verification efforts are presented in Attachment 1. Based on the model calibration and verification results and restrictions, it was concluded that the models could be used to provide comparative data for analyzing alternative diversion sites for the North Bay Aqueduct. The simulation period selected for the NBA model analysis is low flow, summertime hydrology (1976-77). This period represents the most critical hydraulic and water quality conditions. The model has been employed to compare the relative changes in the hydraulic and water quality conditions resulting from the proposed diversions with the base case (no project) situation. Therefore, it should be emphasized that the absolute values of the net flows and TDS and chloride concentrations represent the 1976-77 model input data only, and the results should be interpreted in terms of the relative change between project conditions.

The primary assumptions used in conducting the analysis of the North Bay Aqueduct impacts were the following:

1. Low-flow, summertime hydrologic conditions were used to represent the most critical hydraulic and water quality constraints. The parameters and initial condition data employed by the models were developed from the 1976-77 drought period data base.

2. Net Delta Outflow was set at 3,000 cfs.

3. Exports for the Central Valley Project and the State Water Project were 5,500 cfs.

4. North Bay Aqueduct diversions (110 cfs) were assumed to be compensated for by additional releases to the Sacramento River, therefore, the Net Delta Outflow remained constant.

5. The system is operated with the Delta cross-channel open.

Base Case Conditions

The results of the model simulation for the base (no project) case are presented in Table 1 and Figure 2 The net flows in the model channels provide a general description of the predicted flow regime of the region. As illustrated in Figure 3, the model indicates water flowing from the Sacramento River through Steamboat and Sutter Sloughs to Miner Slough. At the confluence of Miner and Cache Sloughs, water flows upstream into Lindsey and Cache Sloughs and the Sacramento Deep Water Channel and downstream along lower Cache Slough to rejoin the Sacramento River and Steamboat Slough at Rio Vista. The net upstream flows in Lindsey and Cache Sloughs reflect losses to evaporation, groundwater seepage, agricultural withdrawals and municipal diversions.

As a result of the general flow regime predicted by the model simulation, the water quality in the region will more closely reflect the water quality of the Sacramento River as found near Courtland as opposed to the quality found near Rio Vista. The water quality results presented in Figure 2 show a good quality zone at the confluence of Miner and Cache Sloughs (Junction 135). Given the direction of net flows from the junction, it seems reasonable to conclude that the primary source of water and, subsequently, water quality in the vicinity of Lindsey and Cache Sloughs is the Sacramento River just south of Courtland. The slightly higher TDS and Chloride concentrations predicted at Rio Vista reflect the initial edge of the salinity wedge originating in San Francisco Bay. Consequently, the simulated flow regime provides some degree of protection for the region from the higher salinity waters which lie south of Rio Vista and the proposed diversion points.

TABLE 1

HYDRAULIC AND WATER QUALITY QUALITY CHARACTERISTICS
FOR SELECTED MODEL CHANNELS AND JUNCTIONS

	Base Case	Cache Sl. Diversion	Lindsey S Diversion
<u>Hydraulic Characteristics</u>			
Cache Sl. (Channel 185)			
Net Flow (cfs)	1371	1289	1289
Net Flow Direction	Downstream	Downstream	Downstream
Velocity (fps)	0.059	0.059	0.059
Cache Sl. (Channel 187)			
Net Flow (cfs)	144	254	144
Net Flow Direction	Upstream	Upstream	Upstream
Velocity (fps)	0.008	0.014	0.008
Lindsey Sl. (Channel 188)			
Net Flow (cfs)	101	101	211
Net Flow Direction	Upstream	Upstream	Upstream
Velocity (fps)	0.015	0.015	0.031
Miner Sl. (Channel 229)			
Net Flow (cfs)	1724	1751	1751
Net Flow Direction	Downstream	Downstream	Downstream
Velocity (fps)	0.558	0.566	0.566
<u>Water Quality Characteristics</u>			
Cache Sl. (Junction 135)			
TDS (mg/l)	136	134	134
CL (mg/l)	13	12	12
Cache Sl. (Junction 137)			
TDS (mg/l)	143	138	141
CL (mg/l)	13	13	13
Lindsey Sl. (Junction 138)			
TDS (mg/l)	140	139	137
CL (mg/l)	13	13	13

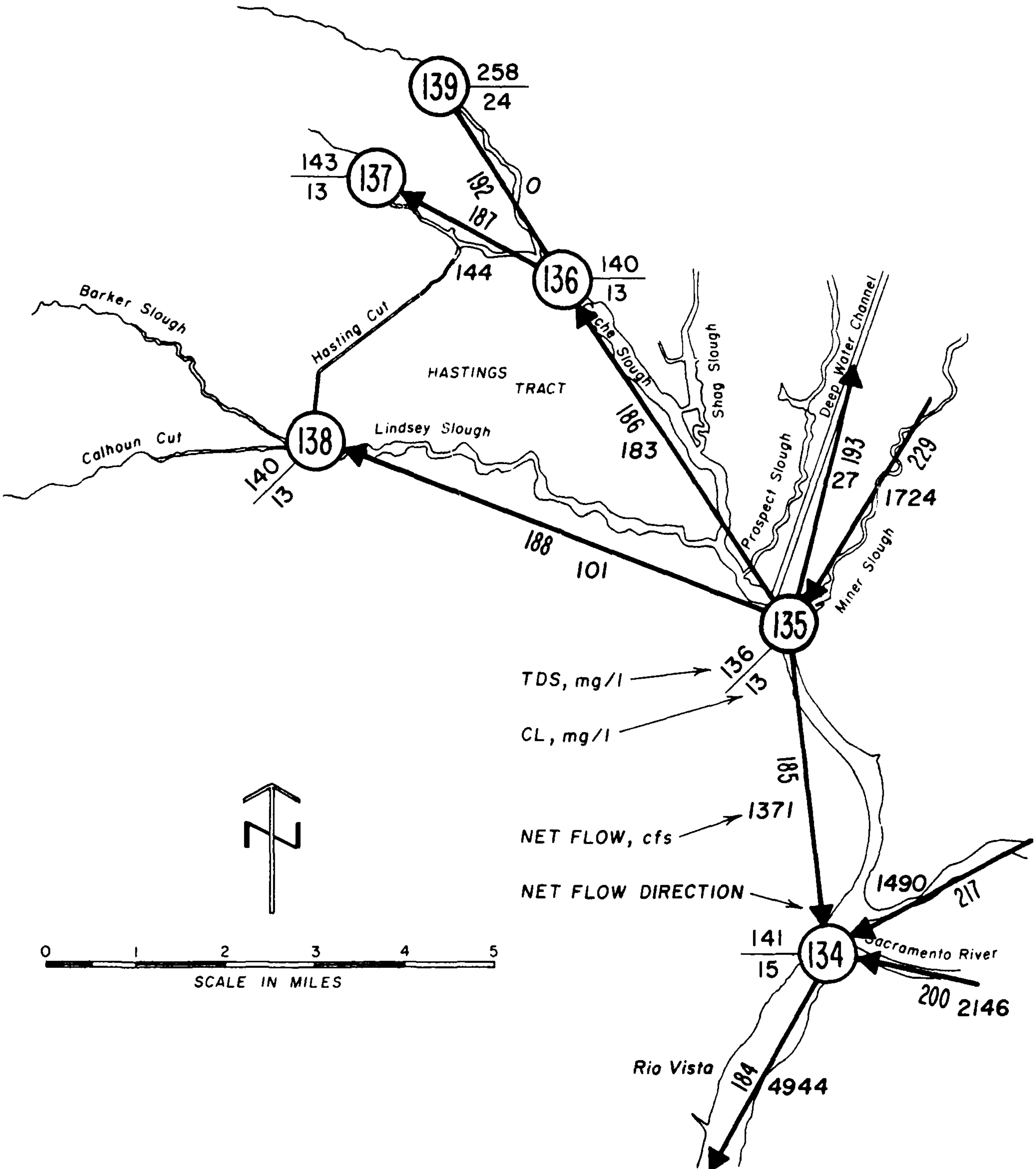


FIGURE 2

BASE CASE CONDITIONS
MODEL RESULTS FOR SELECTED CHANNELS AND JUNCTIONS
IN THE VICINITY OF THE PROPOSED NORTH BAY AQUEDUCT DIVERSION

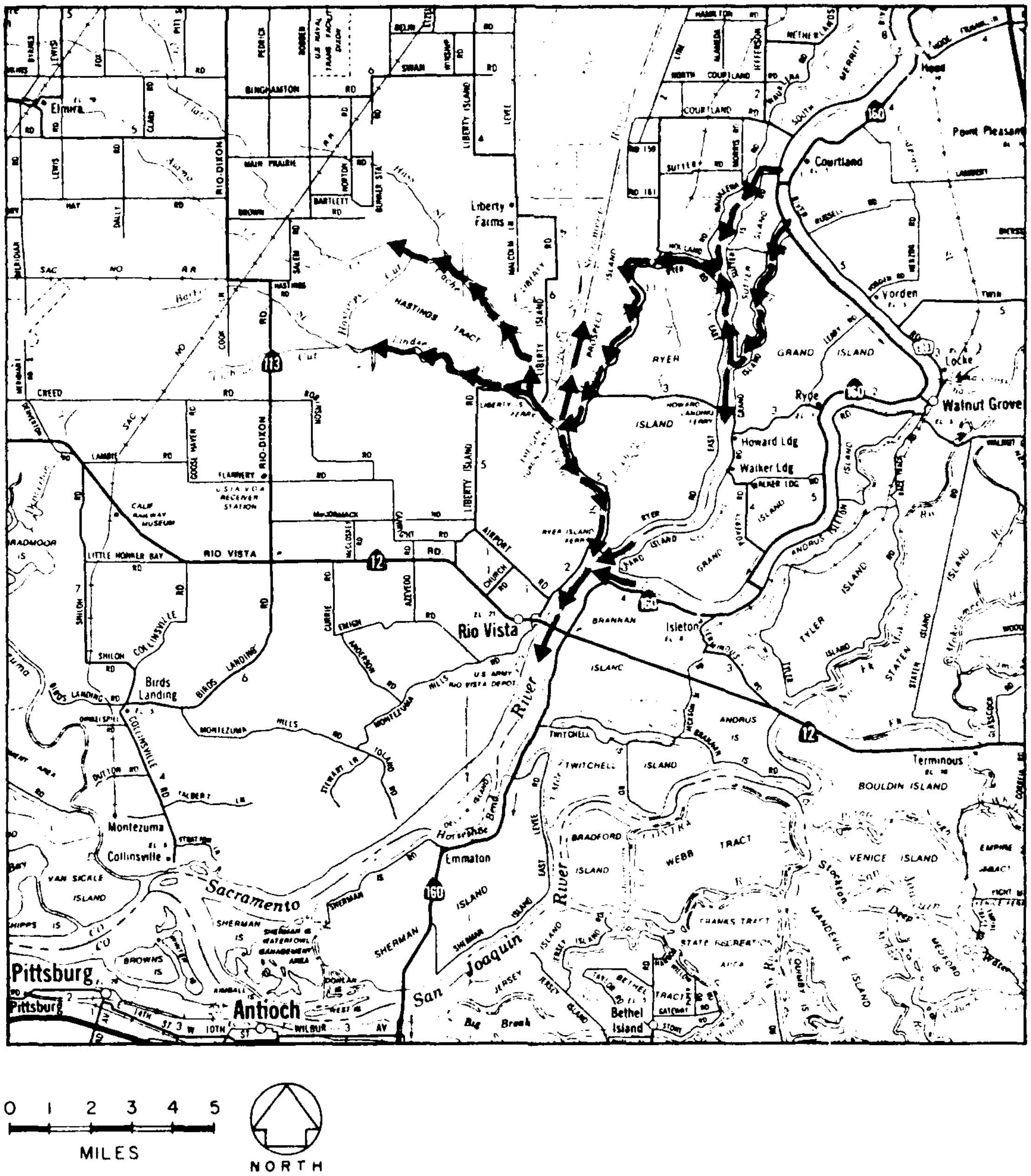


FIGURE 3

GENERAL NET FLOW REGIME IN THE
VICINITY OF THE PROPOSED NORTH BAY AQUEDUCT

Cache Slough Diversion

The effects of a North Bay Aqueduct diversion from Cache Slough are illustrated in Table 1 and Figure 4. Based on the model results, the diversion of 110 cfs would be compensated for by an increase in the net flow in Miner Slough (Channel 229) of 27 cfs and a reduction in the net flow in lower Cache Slough (Channel 185) of 82 cfs. The net flows in Cache Slough (towards the diversion) increase by 110 cfs. The average velocity in Cache Slough (Channel 187) increases from 0.008 fps to 0.014 fps.

Lindsey Slough Diversion

The effects of the Lindsey Slough diversion on the general flow regime are identical to the flows predicted for the Cache Slough diversion. The withdrawal of 110 cfs from Lindsey Slough is compensated for by an increase of 27 cfs in net flow along Miner Slough and an 82 cfs decrease in net flows in the downstream end of Cache Slough (Figure 5). The net flow in Lindsey Slough (Channel 188) increases by 110 cfs and the average velocity increases from 0.015 fps in the Base Case to 0.031 fps with the diversion (Table 1). Net flows in Cache Slough are unaffected by the diversion in Lindsey Slough.

As previously observed, the water quality at the proposed intake site shows an improvement over the base case simulations as a result of the increased flow of higher quality water from the Sacramento River via Miner Slough. The higher quality water from the Sacramento River also results in a residual effect by improving the water quaiity in Cache Slough.

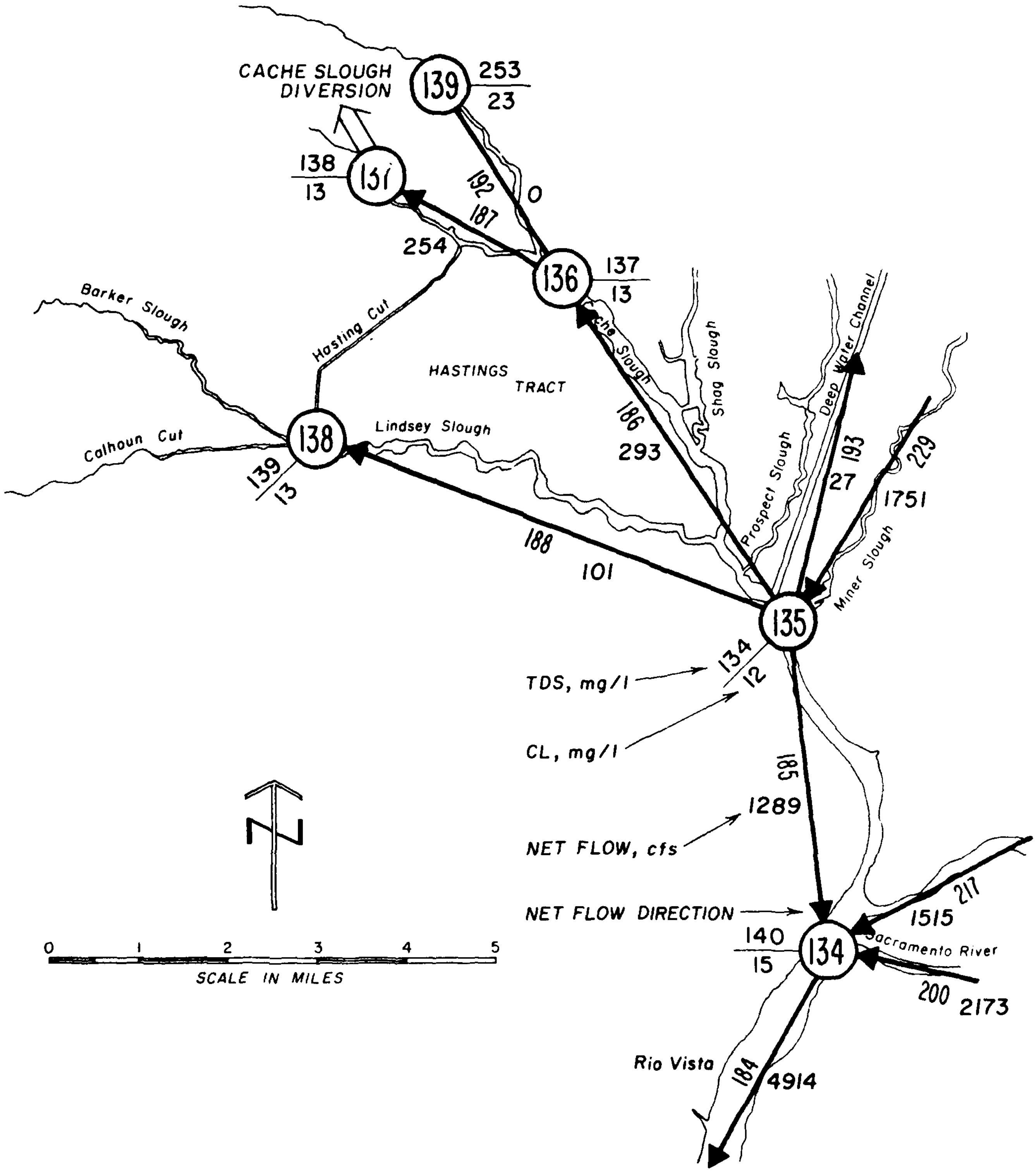


FIGURE 4

CACHE SLOUGH DIVERSION
MODEL RESULTS FOR SELECTED CHANNELS AND JUNCTIONS

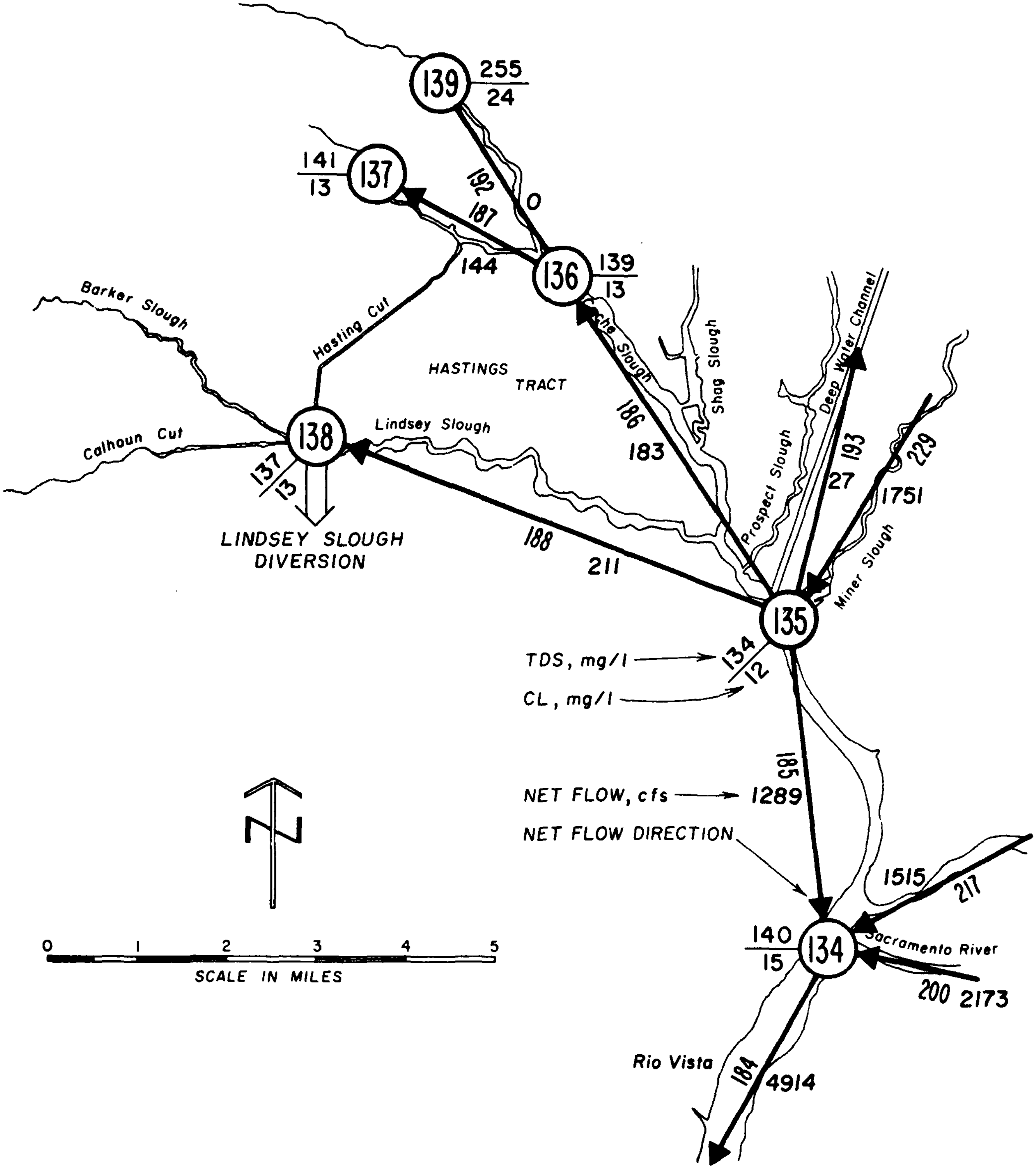


FIGURE 5

LINDSEY SLOUGH DIVERSION
MODEL RESULTS FOR SELECTED CHANNELS AND JUNCTIONS

Calhoun Cut Diversion

The diversion and water quality impacts of a diversion on Calhoun Cut would, essentially, be identical to those simulated for Lindsey Slough. The major difference would occur in the average flow velocity which, depending on the channel geometry, would be greater than that simulated for Lindsey Slough. Water quality would, generally, be the same as predicted for Lindsey Slough.

Conclusions

Based on the results of the model simulations, the impacts of the proposed North Bay Aqueduct diversions on Cache Slough, Lindsey Slough and Calhoun Cut can be summarized as follows:

1. Approximately 25 percent of the required diversion flows will be met by increased flows from the central Sacramento River region just south of Courtland via Steamboat, Sutter and Miner Sloughs. The remaining 75 percent will be supplied by a reduction in downstream net flows along Cache Slough to Rio Vista.

2. The diversion will result in an increase of 110 cfs in the net upstream flows in the respective channels and a corresponding increase in the flow velocities. The increased flows amount to approximately six to nine percent of the total average (predicted) flows for Cache and Lindsey Sloughs, respectively. For Cache and Lindsey Sloughs, the predicted velocities would increase to 0.014 fps and 0.031 fps, respectively. The flows and velocities in Calhoun Cut would be higher due to the smaller channel size.

3. Due to the general net flow regime indicated by the model simulations, the diversions will result in an improvement of the water quality in the region.

It should be noted that the proposed Peripheral Canal may have significant effects on the expected water quality in the region. As proposed, the Peripheral Canal would divert Sacramento River water above Courtland to the State's Delta Pumping Plant with provisions for small releases into sloughs along the eastern side of the Delta. Although net Delta outflow would be maintained, the redistribution of flows in the Delta could result in increased salt water intrusion up the Sacramento River as a result of the lower Sacramento River flows. Consequently, the possibility exists for reversing the net flows in the lower end of Cache Slough and thus introducing lower quality water into the region of the proposed North Bay Aqueduct diversion.

ATTACHMENT 1

CALIBRATION AND VERIFICATION OF HYDRAULIC AND WATER QUALITY MODEL

The calibration and verification of the models used in the Delta Water Rights Hearing involved three major tasks.

TASK I. DEVELOPMENT OF A MODELING PROGRAM

1. Development of a program for the use of mathematical models during the Delta hearings.
2. Incorporate improvements and modifications made by WRE, the Department of Water Resources (DWR) and the U.S. Bureau of Reclamation (USBR) to the basic Bay-Delta model.
3. Review available water quality and hydraulic data for use in the model calibrations.

During the early stages of the project, several meetings were held with Steve Macaulay from the State Board, Ed Huntley, Rich Lerseth and Jim Snow from DWR and Rich Cristoff from USBR. DWR and USBR provided programs, data decks and listings for each of their models as well as sample outputs. This information was reviewed and differences in basic data were identified. The State Board, WRE, DWR and USBR reviewed these discrepancies and jointly recommended a modified data set. These modifications included several adjustments to the data defining Delta channel properties and roughness coefficients which had been developed by DWR and USBR in previous modeling efforts. At the completion of Task I, WRE concluded that a modeling program using the existing WRE tidal hydraulics and water quality models in conjunction with the modified data set for Delta channel and junction characteristics would be appropriate for the remaining tasks.

Hydrodynamic Model

Initial tidal hydraulic recalibration attempts using the data base developed in Task I were not successful. DWR indicated similar problems in calibrating their model with the same data base. It was therefore concluded that the channel roughness coefficients had to be recalibrated as a result of changes in channel geometry. The following three figures present the final recalibration results of the hydraulics model along the Sacramento, San Joaquin and Old Rivers. The results for the Sacramento River provide a good approximation of the field data. In general, the error ranged from +0.1 to -0.3 feet for higher high water levels and +0.1 to -0.8 feet for lower low water levels. The major calibration difficulty was simulated values that were too low in the Collinsville-Rio Vista region. Calibration results for the San Joaquin and Old Rivers were generally low and within 0.5 feet of measured tide levels. These results reflect difficulties encountered with boundary conditions at Mossdale Bridge and the low tide levels simulated in the Collinsville-Rio Vista region of the Delta. It was concluded that the southern boundary of the model should be extended along the San Joaquin River from Mossdale Bridge to Vernalis to reduce errors introduced at the Delta boundary. The model extension was made after the hydraulic calibration and prior to beginning the water quality model calibration.

Water Quality Model

WRE selected May-July 1976 for calibration of the water quality models and August-October 1976 for their verification. These periods represent the best available data for low flow conditions. The final hydrologic periods used for the calibration and verification process were:

Calibration

Period 1	May 1976
Period 2	June 1976
Period 3	July 1976

TASK II. PREPARATION OF OPERATIONAL HYDRODYNAMIC AND WATER QUALITY MODELS

Task II objectives were to review available hydrologic and water quality data and to develop a reliable data base for use in calibrating and verifying the hydraulic and water quality models. During this task WRE concluded that documented tide data for the August 18-19, 1959 period provided the best data base for calibrating the hydraulic model and data for May through October 1976 would be used to calibrate and verify the water quality model under low flow conditions.

With the assistance of the State Board, WRE compiled an extensive and well documented data base for use in model calibration and verification. The water quality model was modified to handle each source and withdrawal of water separately; this change required data to handle the individual component parts rather than treating them in total as net Delta consumptive use. The major problem encountered during this phase of the project was the availability of adequate data on the distribution of agricultural withdrawals and returns and their corresponding water quality. The allocation of agricultural withdrawals was based on the data and methods developed in the Bay-Delta study by DWR and WRE. In the case of agricultural returns, an approach was selected to estimate return flow concentrations on the basis of the weighted average water quality of the various contributing sources.

TASK III. CALIBRATION OF HYDRODYNAMIC AND WATER QUALITY MODELS

Task III involved recalibration of the tidal hydraulics model for the August 18-19, 1959 period and the calibration and verification of the water quality model using the May-October 1976 data developed in Task II.

Verification

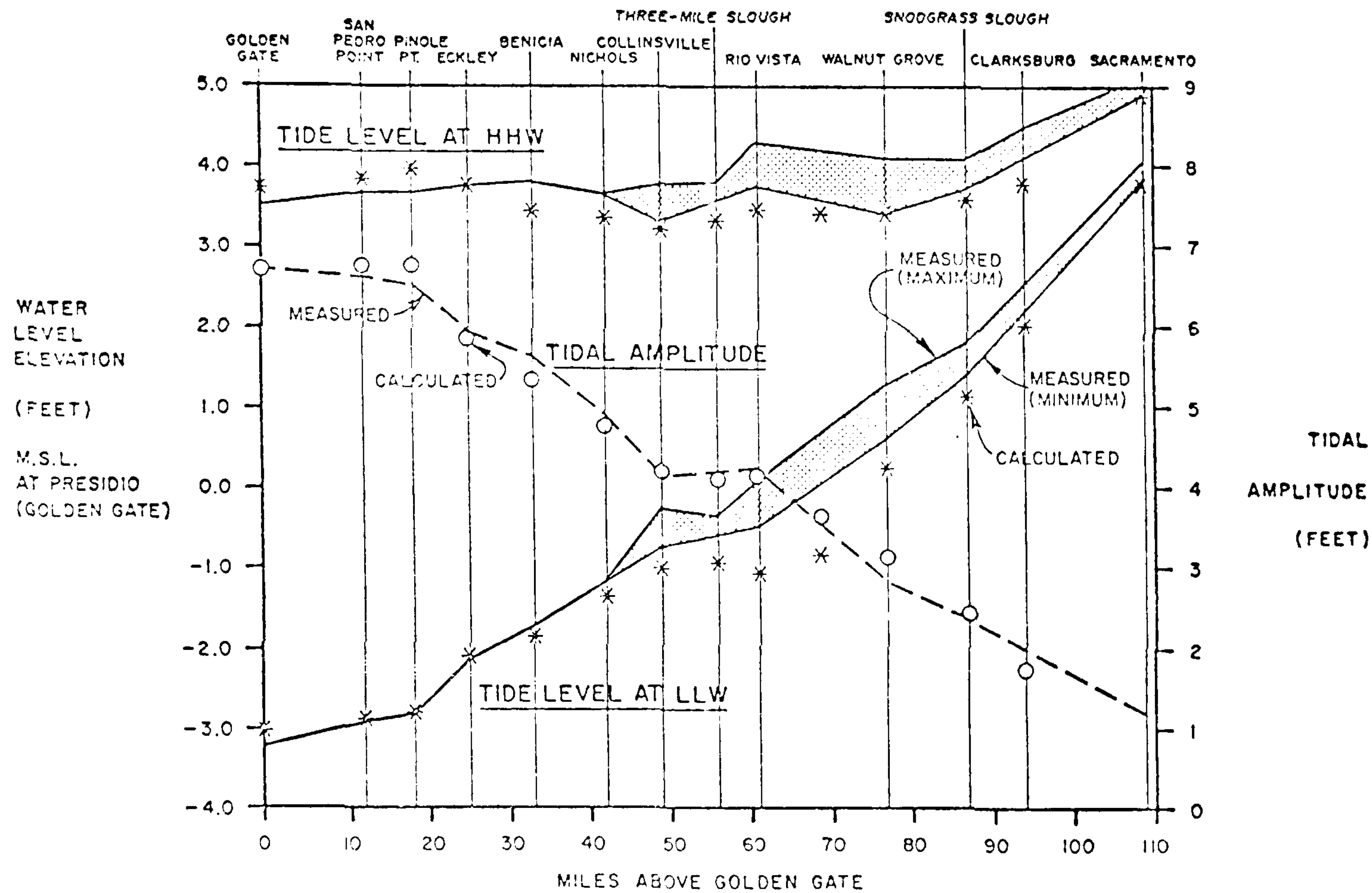
Period 4	August 1-15, 1976
Period 5	August 16 - September 20, 1976
Period 6	September 21 - October 10, 1976
Period 7	October 11-31, 1976

The water quality calibration results compared favorably with field data for Martinez, Pittsburg, Emmaton, San Andreas Landing, points along Old River and Vernalis. Primary difficulties were the result of dividing the calibration periods on the basis of months as opposed to inflow and export conditions. Monthly periods did not provide accurate enough hydraulic simulations which, in turn, resulted in simulating average TDS values which, in some cases, were not representative of actual conditions. This procedure was modified for model verification and the periods were selected on the basis of Sacramento River inflow and export pumping.

When the verification periods were simulated, the results were unsatisfactory during periods 5 and 6 for stations from Antioch to San Andreas along the San Joaquin River and down Old River to Clifton Court. The results indicated that the model advected an excessive amount of salt water up the San Joaquin River during these two periods, which represented low flow-high export conditions. Consequently, adjustments were made to the mixing coefficients in Three-Mile Slough and the channel connecting Antioch and Collinsville to reduce salt water intrusion for the combined calibration and verification periods. As a result of these changes the model simulated values below actual field data for all stations (except Antioch and Blind Point) during the first four hydrologic periods and above field values for the final three periods. Simulations at Martinez, Pittsburg, Emmaton, San Andreas, Victoria Canal, Delta Mendota Canal, Union Island and Vernalis provided the best results. Stations between Pittsburg and San Andreas on the San Joaquin River and along Old River to Clifton Court were unsatisfactory during the periods 5 and 6 due to the continued prediction of high salt water intrusion. The following figures present the calibration

and verification results for Emmaton, Antioch and San Andreas Landing; these results are representative of the calibration and verification.

As the results indicate, during low flow-high export conditions (as found in periods 5 and 6), the model overestimates advection of salt water up the San Joaquin River to San Andreas and then south along Old River to Clifton Court. Since field data did not reflect the same behavior, WRE investigated the cause of the high salt water advection in the model and have concluded that geometric and hydraulic data in the Pittsburg-Collinsville-Antioch area may be inaccurate for simulating hydraulic behavior during these flow conditions. Therefore, it appears that the current model is limited to low flow conditions when total exports do not exceed 7,000 cfs.



SACRAMENTO RIVER
AUGUST 18-19, 1959
CALIBRATION RUN #5

FIGURE 1

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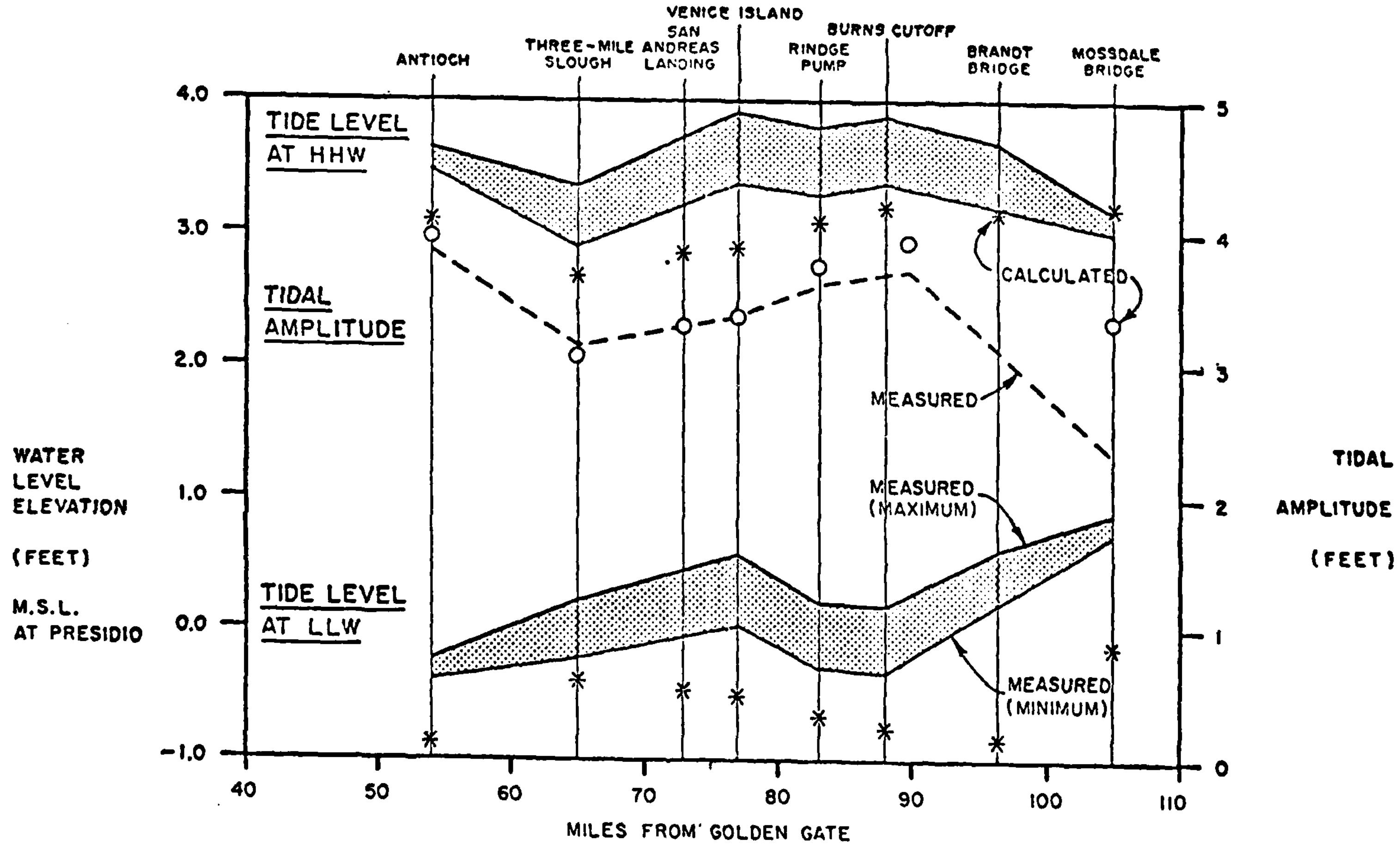
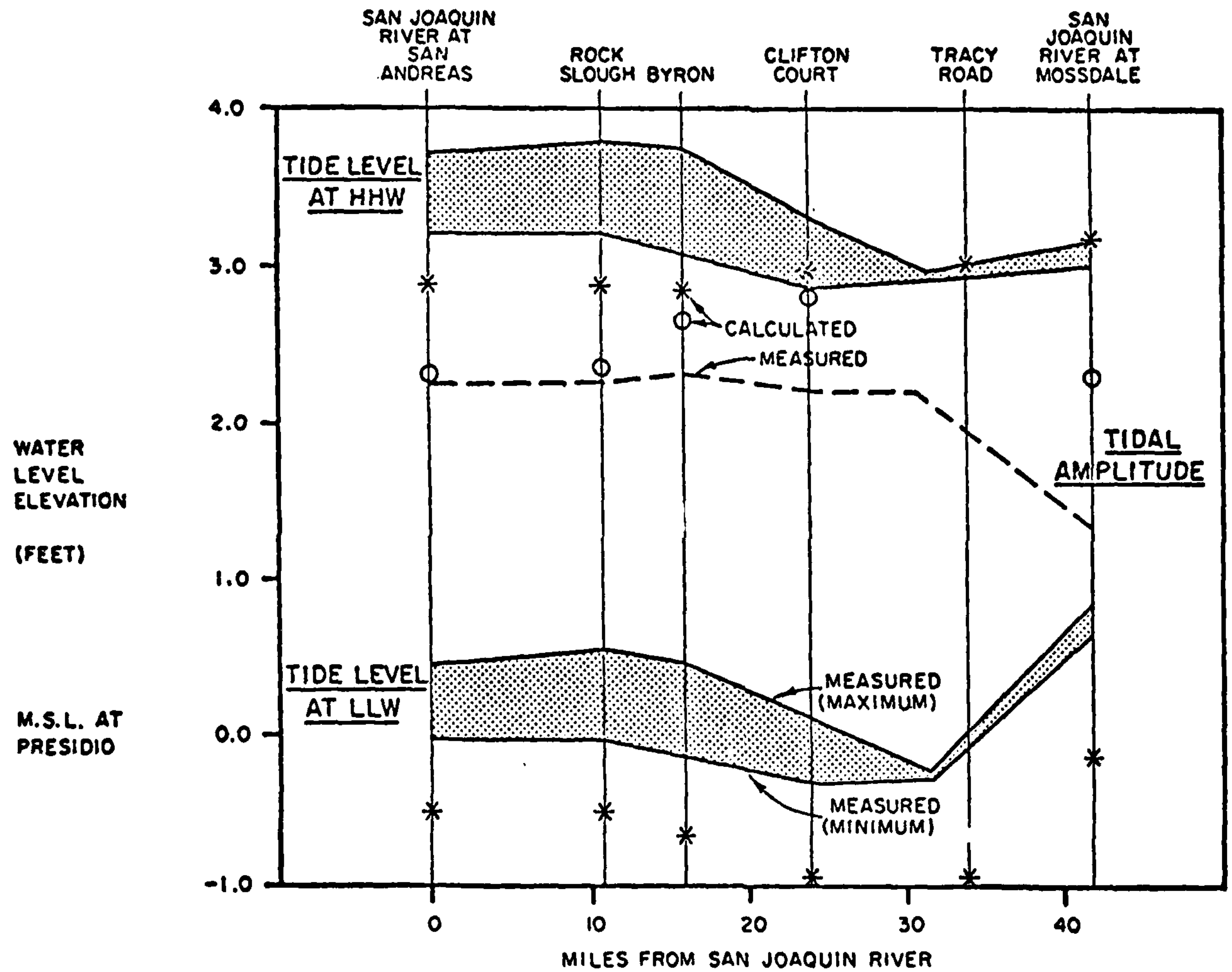


SAN JOAQUIN RIVER
AUGUST 18-19, 1959
CALIBRATION RUN #5

FIGURE 2



OLD RIVER
AUGUST 18-19, 1959
CALIBRATION RUN #5

FIGURE 3

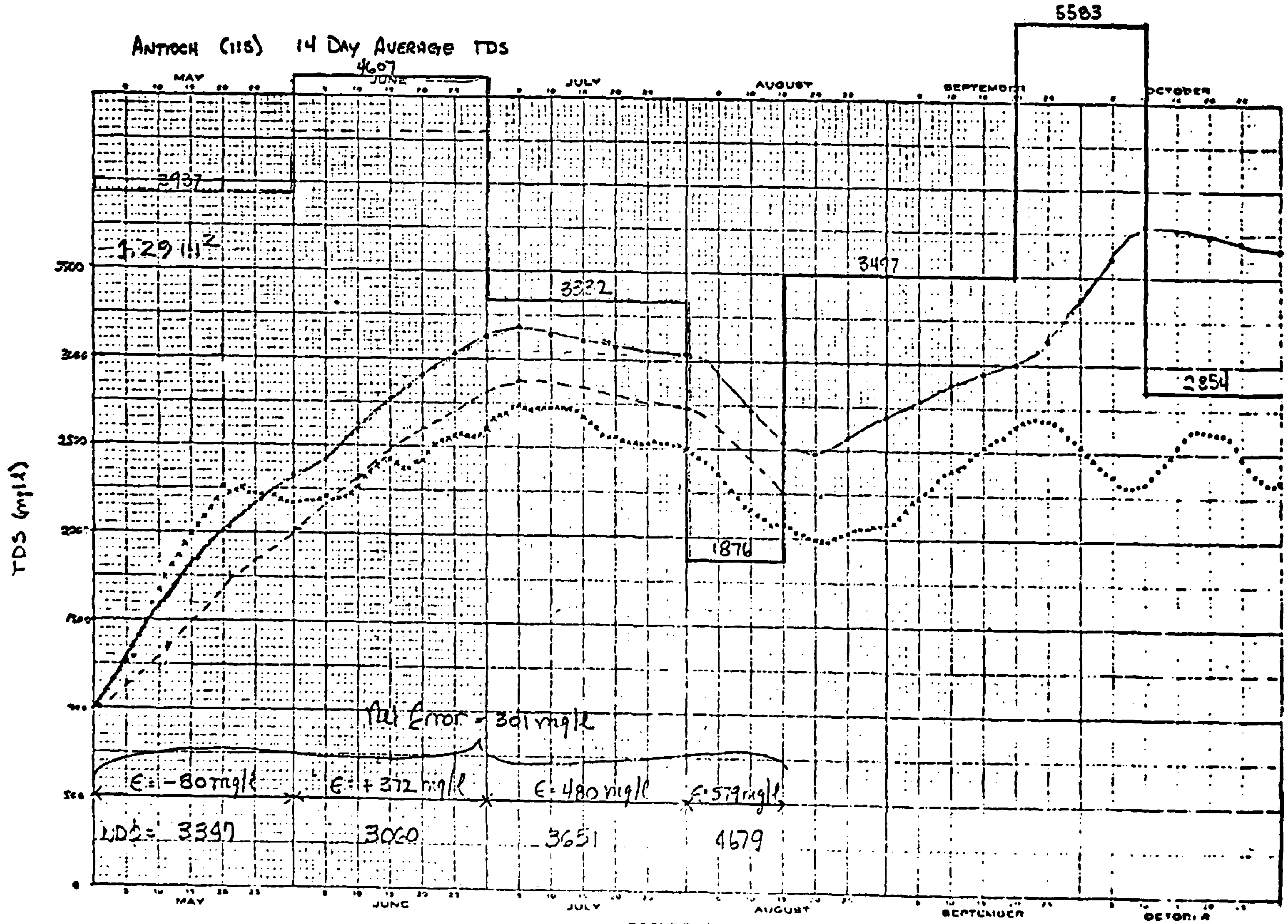

ANTIOCH (115) 14 DAY AVERAGE TDS
TDS (mg/l)
MAY
JUNE
JULY
AUGUST
SEPTEMBER
OCTOBER
4607
2937
1.29 (1)²
3322
3497
5583
2854
1876
Net Error = 301 mg/l
E = -80 mg/l
E = +372 mg/l
E = 480 mg/l
E = 579 mg/l
UDZ = 3397
3060
3651
4679

FIGURE 4

Emmaton 14-day average TDS values

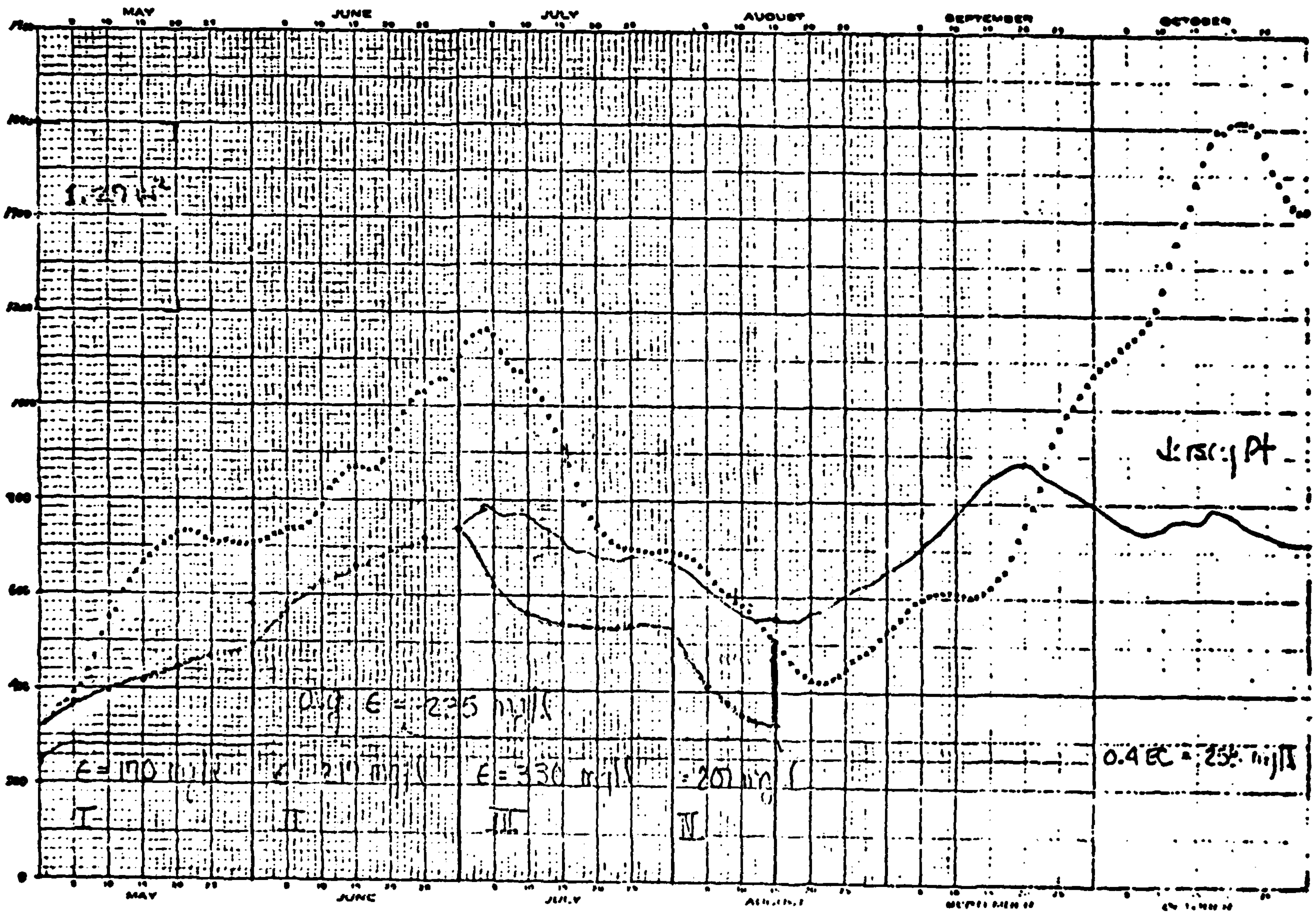
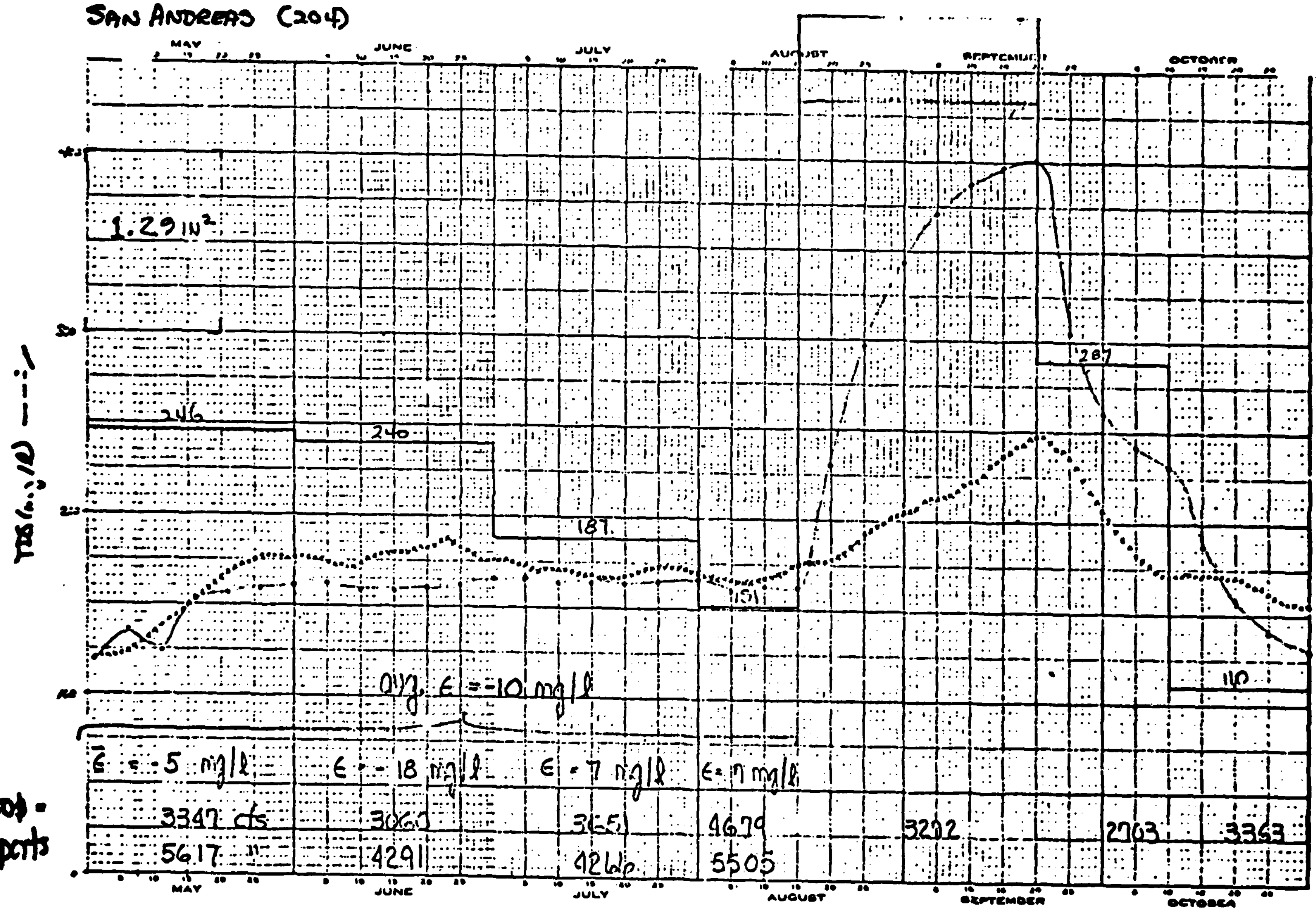


FIGURE 5



SAN ANDREAS (204)
TDS (mg/l)
1.29 IN²
246
240
187
151
287
110
avg. ε = -10 mg/l
ε = -5 mg/l
ε = -18 mg/l
ε = 7 mg/l
ε = 7 mg/l
WDI = Exports
3347 cfs
5617 "
3063
4291
3651
4266
4679
5505
3202
2703
3363
MAY
JUNE
JULY
AUGUST
SEPTEMBER
OCTOBER

FIGURE 6

APPENDIX G

WATER CONSERVATION ASSUMPTIONS OF DWR'S WATER ACTION PLAN FOR THE SOUTHWEST SACRAMENTO VALLEY SERVICE AREA

(This appendix describes the water conservation measures involved in a program whose existence was assumed by the preparers of the Water Action Plan for the Southwest Sacramento Valley Service Area for estimating "conservation" demand. The estimates appear in Tables 3-2 and 3-13 of this EIR/EIS. The text of this appendix was exerpted directly from DWR's Water Action Plan for the Central and South San Francisco Bay Area, 1979.)

Potential for Urban Water Conservation

Water conservation is important because it can free presently developed water supplies for other uses or can delay the time when future water supplies need to be developed. *Conservation indicates more efficient* use of water, or using smaller amounts of water to satisfactorily perform the same function as larger amounts of water. In some cases, this can be accomplished by changing or modifying a plumbing fixture or appliance with no behavioral change needed from the user. Other savings involve a change in behavior or habits, such as using less water for landscape irrigation.

DWR has analyzed the potential water savings in the entire San Francisco Bay Basin 1/ for the following categories: municipal interior and exterior, industrial, and water purveyor/distributor leak detection and repair.

To analyze the potential water savings in the municipal interior and exterior category, DWR analyzed residential water use only. Although municipal also includes commercial and governmental uses, potential water savings were assumed to be in the same proportion as residential.

1/ San Francisco Bay Basin, as designated by the "Water Quality Control Plan Report, San Francisco Bay Basin", SWRCB, 1975.

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Based on the analysis, DWR estimated that the reduction in urban water demand for the San Francisco Bay Basin 1/ with implementation of a water conservation program would be about 7 percent in 1980, 14 percent in 1990, and 17 percent in the year 2000. Assuming the percentages are also applicable to the study area, water savings in the central and south San Francisco Bay area, using the DWR E-150 water demand projections, would be 74 hm^3 in 1980, 169 hm^3 in 1990, and 228 hm^3 in 2000. (In Alameda and Contra Costa Counties, DWR projected that the future increase in industrial water demand would be approximately equal to the reduction in water use because of additional recycling. Therefore, the industrial water demand in Alameda and Contra Costa Counties was subtracted from the DWR projections before applying the water-saving percentages. The resulting percentage reductions were 6 percent in 1980, 13 percent in 1990, and 15 percent in 2000).

The various water-savings categories and the potential savings, used in computing water savings for the San Francisco Bay Basin 1/, are discussed in the following paragraphs. In addition, DWR water-savings projections are compared with those developed by J. B. Gilbert and Associates for ABAG.

Interior Use

Based on studies of several water systems in the San Francisco Bay Basin 1/, it was assumed that of the total municipal demand, 65 percent is for interior use and 35 percent is for exterior use.

1/ San Francisco Bay Basin, as designated by the "Water Quality Control Plan Report, San Francisco Bay Basin", SWRCB, 1975.

Potential interior savings have been estimated for five activities: new construction, replacement of demolished structures, rehabilitation or remodeling of existing structures, replacement of worn-out appliances and fixtures, retrofitting of water conservation devices in existing fixtures, and changing personal water-use habits through conservation awareness.

New Construction. New construction here refers to structures added due to increased demand for housing. In 1976 the California Legislature passed AB 1395, which requires that after January 1, 1978, newly installed toilets will have a maximum flush of 3.5 gallons (13.2 litres). Previously toilets required 5 to 7 gallons per flush. According to DWR Bulletin 198, this will amount to an 18 percent reduction in interior use or when multiplied by 65 percent interior use, an 11.7 percent reduction in municipal demand.

The Regulation for Appliance Efficiency Standards as amended on December 22, 1977, by the Energy Resources Construction and Development Commission, established maximum flow rates for shower heads, lavatory faucets and sink faucets sold or offered for sale in California after that date.

For shower heads the maximum flow rates are either 2.75 or 3.00 gallons per minute (10.4 or 11.4 litres per minute), depending on the pressure. For lavatory and sink faucets the maximum flow rate is 2.75 gpm (10.4 lpm). The effect of these measures (not including toilets) would be a reduction of 24 percent of indoor use, or 15.6 percent of municipal demand. The effect including the toilet legislation is to decrease interior residential use by 42 percent and total municipal use by 27.3 percent. The reduction factors are applied to the increase in municipal demand brought about by the added structures.

Demolition. A certain number of existing structures will be demolished. Replacement structures must meet the same water-conservation criteria as new construction.

The Southern California Association of Governments (SCAG) projected that 6 percent of the housing units existing in 1975 may be demolished by 2000. It was assumed this would be the same for the Bay area. Using a straight-line projection, this would be about 0.24 percent per year. This percentage times the number of years and times the conservation reduction factors gives the reduction to be applied for each of the future years. The reductions are applied to present municipal demand.

Rehabilitation. In addition to new construction and demolition, a certain amount of rehabilitation and remodeling will be accomplished within the study area. SCAG's estimated rehabilitation needs of 8 percent of existing units were assumed to be the same for the Bay area. Since information on rehabilitation actually accomplished is minimal and was not predicted, a 25 percent accomplishment factor, or 2 percent of existing units by year 2000, was assumed. Rehabilitation would include plumbing fixtures in accordance with the conservation requirements of new construction except for pressure-reducing valves and hot-water-pipe insulation. The reduction per unit rehabilitated will be 11.7 percent before 1980 and 20.8 percent thereafter. Reductions are applied to present municipal demand.

Replacement. Surveys by DWR and others have shown that the expected life of faucets and washing machines varies from 6-10 years, depending upon the quality of the water. For this report, a useful life of 10 years is assumed. It is also assumed that after 1980 as they wear out they will be replaced with water-saving models. A 9.1 percent reduction in municipal demand is projected for each unit. One-half of the replacement will

take place by 1990 and the remainder by 2000. Although toilet mechanisms will also wear out after 10 years or less, replacement with existing type parts is assumed, with no resultant savings.

Retrofit. Installation of retrofit devices can reduce interior water use by 20 percent. The devices include toilet tank displacement dams or other toilet devices, and low-flow shower heads or shower flow restrictors. By 1980 every household in the study area probably will have had an opportunity to secure these devices in conservation kits and, based on previous conservation programs, 30 percent of the households will install the devices. Twenty percent reduction of 30 percent of households times 65 percent interior use gives a reduction to present municipal demand of 3.9 percent in 1980. This will be reduced to less than one percent by 2000, as retrofitted fixtures are replaced with new water-conserving fixtures due to demolition, rehabilitation, and replacement.

Changing Personal Water Use Habits. Another way in which significant water conservation could be effected would be by changing personal water use habits. These could include not running faucet water continuously while brushing teeth or shaving, systematically repairing leaking plumbing, washing only full loads of dishes and clothes, not using toilet as waste receptacle, taking shorter showers, and others.

During the 1976-77 drought, the San Francisco Bay Region, as with many other areas in the State, responded to curtailment in water supply by various means, including public education on water conservation awareness that appealed to change in personal water use habits to eliminate waste and use of water.

A quantitative evaluation of the water savings from changing personal habits was not included in the study because there is insufficient basis to

predict long-term effects on water conservation. The recent two drought years' experience have shown, however, that they can contribute significantly to water savings.

Exterior Use

The largest portion of exterior water use, about 90 percent, is used for irrigating lawns, shrubs, and home vegetable gardens. The remaining 10 percent is used for car washing, swimming pools, and cleaning driveways, sidewalks and streets. Substantial reduction in use could be achieved by educating the public on proper watering techniques to eliminate overwatering and waste. According to Bulletin 198, 20 percent of applied exterior water is in excess of demands. Therefore, a reduction of 5 percent should be attainable and was assumed for this report.

The use of low-water-using plants or landscaping with no water use, such as gravel or rock, can save appreciable amounts of water. This type of landscaping would most likely be done in areas of new construction and a reduction of 10 percent in the increased exterior demand can be expected.

Industrial Use

Reduction in industrial use will occur because of the necessity to reduce energy and sewer discharge costs, replace old equipment as it wears out with more efficient equipment, use efficient equipment and processes in future plants and industries, and recycle and reclaim water. This will produce an assumed savings of 5 percent in 1980, 15 percent in 1990, and 17 percent in 2000.

Leak Detection and Repair

Water savings would be effected through initiation of a delivery system leak-detection program. A study by EBMUD concluded that a utility with about 8 percent unaccounted-for-water could effect a detection and repair program resulting in a 2 percent reduction in total demand.

A detailed analysis of each water supply system, which would be required to determine the potential water savings from a leak-detection program, was beyond the scope of this study. However, a goal of one percent for 1980 and two percent thereafter seemed reasonable, and was used for estimating potential water savings.

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